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SEC DONOHUE

WORKPLAN TO PROVIDE LIMITED SUBSURFACE ENVIRONMENTAL ASSESSMENT INVESTIGATION SERVICES

NUPLA PLASTIC CORPORATION
11912 SHELDON STREET
SUN VALLEY, CA 91352

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August 26, 1992

Project No. A3459.00
Nupla Plastic Corporation
11912 Sheldon Street
Sun Valley, CA 91352
Attn: Mr. Jody Hill

WORKPLAN TO PROVIDE LIMITED SUBSURFACE ENVIRONMENTAL ASSESSMENT INVESTIGATION SERVICES

Dear Mr. Hill:

In accordance with your request, *SEC Donohue, Inc. (SEC)* is pleased to submit this workplan for limited subsurface environmental assessment investigation services to be provided for *Nupla Plastic Corporation (NPC)*, at 11912 Sheldon Street, Sun Valley, California.

INTRODUCTION

Based on information provided by *NPC*, it is our understanding that the site encompasses a 30-year-old fiberglass products manufacturing facility that includes an extrusion-pultrusion building approximately 80 feet wide and 403 feet long, an injection molding building approximately 80 feet wide and 260 feet long, a small office building, and a chemical storage shed containing 10 above-ground storage tanks (see Figure 1).

During a site visit by an inspector from the California Regional Water Quality Control Board of Los Angeles (CRWQCB/LA) on April 7, 1992, several conditions (summarized in letter dated June 19, 1992) that may result in potential soil and groundwater pollution were observed. More specifically, obvious signs of machine oil discharge were observed inside the rear building throughout the injection molding area, and also outside on the bare soil adjacent to the injection molding area. In addition, hazardous waste manifests or hauler reports for waste oil disposal were not provided at the time of the inspection.

PROPOSED SCOPE OF SERVICES

With the above in mind, the general technical approach for the site investigation is provided in the following workplan. Listed on the following pages is an itemized summary of our proposed tasks for investigating the lateral and vertical extent of waste oil and other types of suspected contamination at the site. Specific investigative methodology is provided in the *SEC* protocol guidelines (see Appendix A).

1.0 Facility Audit Review

Review facility audits provided by *NPC* as necessary to decide if supplemental (i.e, beyond that specified by the CRWQCB/LA) investigation methods and/or analytical procedures need to be amended to the workplan.

2.0 Site Safety Plan

Prior to beginning the field work, a Site Safety Plan will be developed for the protection of *SEC* personnel working on the project site. An evaluation will be made as to which level of protection will be required. In the event that it becomes evident during the completion of Tasks 4,5,6,7,8 and 9 that a modification of the Site Safety Plan is in order, *NPC* will be notified, and the appropriate changes will be made.

3.0 Underground Utility Location Survey

The third task of our study will be an underground utility location survey. *SEC* will contact Underground Service Alert (USA) to locate underground utilities in the right-of-ways(s) adjacent to the site which may be encountered during drilling. *SEC* will use an underground pipe and line detector to help locate underground utilities on the private property, but *SEC* will not assume responsibility for damage to unknown or unlocated utilities or other underground structures. We assume *NPC* will provide *SEC* with any information or drawings that are known to them which give the location of underground structures which may be encountered. In addition, we assume that the attached plot plan (see Figure 1) provides the location of all above-ground storage tanks on the site. Also, it is our understanding that these tanks are directly filled and emptied by manual valve systems and are not connected to product pipelines.

4.0 Exploratory Soil Borings and Soil Sample Collection

The fourth task of our investigation will consist of advancing soil borings on the site. All drilling operations will be attempted with a limited access, truck-mounted drill rig utilizing a hollow-stem auger system with an 7-inch± diameter auger. We anticipate advancing the borings to a depth of 10 feet; however, if contamination is encountered, the borings may have to be extended 10 feet or more past last measured contamination, as discerned by field observations and measurements and/or directed by the CRWQCB/LA. This task will include the following:

4.1 Obtain permits, as required, to install exploratory soil borings on the site. There is generally a minimum review period of five working days for permits to be approved.

4.2 Perform concrete slab coring as necessary to facilitate soil boring placement.

4.3 Advance five (5) exploratory borings with a 7-inch± diameter auger to a depth of 10 feet below grade in selected areas on the site (see Figure 1). Boring locations B-1, B-2, and B-3 were chosen based on initial CRWQCB/LA directives (letter dated June 19, 1992) and boring locations B-4 and B-5 were chosen by *SEC* due to the possibility that other types of contamination, as indicated from initial *SEC* site visits and reviews of the facility audits, may be present in these areas. A *SEC* registered geologist will log all borings and soil samples according to the Unified Soil Classification System (USCS).

Note: Limited access drill rigs usually have a 7-inch± diameter auger depth limit of 40 feet below surface grade (fbsg). Accordingly, placement of 7-inch± diameter borings to greater than 40 fbsg would generally require the use of a full-size drill rig and a loss of limited access capability.

4.4 Collect soil samples at depths of one (1), five (5), and ten (10) fbsg with an additional sample directly above the water table (if encountered) and between the aforementioned depths if contamination is suspected. Samples will be obtained with a 3.0-inch outside diameter split-spoon sampler containing three 2.5-inch diameter by 6-inch long stainless steel tubes. The bottom tube will be sealed with Teflon™-lined lids and delivered to a State Department of Health Services (DOHS) certified analytical laboratory for analysis. The middle tube will be sealed with Teflon™-lined lids and hand delivered to a DOHS certified on-site mobile laboratory as required for analysis. The bit and augers will be steam cleaned prior to arrival on the site (and between borings, if necessary) to reduce the potential for cross-contamination. The soil samplers and sampling tubes will be washed in a solution of distilled water and appropriate detergent (i.e., sodium triphosphate or an alternate CRWQCB/LA approved compound) and double rinsed with distilled water between sampling intervals to reduce the potential for cross-contamination between samples. Rinse blanks from the drilling and sampling equipment, as well as trip blanks, will be utilized in accordance with *SEC* quality assurance/quality control procedures and/or as specified by the CRWQCB/LA. A description of the soil sampling protocol is provided in Appendix A.

4.5 Take organic vapor analyzer (OVA) readings of soil samples with a portable flame ionization detector (FID) calibrated with hexane to measure the approximate amount of volatile organic compound (VOC) soil contamination and to monitor for changes in the amount of VOC soil contamination with increasing depth.

4.6 The client shall be responsible for the secure containment and storage of all waste materials generated during the course of this investigation that are known or suspected to be hazardous. These materials may include but are not necessarily limited to excavated soil, groundwater removed from wells, decontamination rinse solutions, and used personal protection clothing.

In accordance with generally accepted regulatory agency protocols, *SEC* will segregate and place the aforementioned materials in appropriate sealable and properly labelled containers. Relatively small quantities of these materials are normally stored in Department of Transportation (DOT) 17H 55 gallon drums, whereas larger quantities (i.e., stockpiled soil) must be underlined and covered with visqueen which is clip-closed on the edges, or placed in covered rolloffs, end dumps or Baker-type tanks.

Secure storage generally implies placement of the containers in a restricted area with a minimal visual impact. As an example, a typical storage facility might include a 6-foot high cyclone fence with visual barrier slats and a lockable gate. Additional security items could include lighting, remote video cameras, placards, alarms systems, and guard patrols.

Should the client desire to have the contained materials removed from the site, *SEC* can be retained to coordinate disposal operations at an additional negotiated cost specified in a written proposal, change order, or contract.

4.7 Following the collection of soil samples, the five exploratory borings must either be properly abandoned or completed as groundwater monitoring wells. Those boreholes to be abandoned will be backfilled with an inert bentonite grout to approximately 1 foot below grade and then filled to the surface with concrete.

5.0 Installation of Groundwater Monitoring Wells

If groundwater is encountered during the placement of the soil borings, the CRWQCB/LA and *NPC* will be contacted to discuss the findings before *SEC* proceeds with additional work. Upon approval (including a signed proposal, change order, or contract, and appropriate well permits),the borings will be extended into the groundwater and completed as groundwater monitoring wells. In order to accomplish this task, we would typically do the following:

5.1 Extend the soil borings with a 10-inch diameter auger to a depth of 20 feet below the upper limit of the zone of saturation, but not through clay layers that are below the water table and greater than five-feet thick. The wells will be constructed using a minimum 4-inch diameter flush threaded well screen (with the slot size and material based on soil grain-size analysis and/or CRWQCB/LA specifications) and blank casing.

Note: Limited access drill rigs usually have a 10-inch diameter auger depth limit of 25 fbsg. Accordingly, placement of 10-inch diameter borings to greater than 25 fbsg would generally require the use of a full-size drill rig and a loss of limited access capabilities.

5.2 Fill the annular space (i.e., between the boring sidewall and casing) with a filter pack consisting of well-rounded sand grains, sized in accordance with a grain-size analysis of the soils in the saturated zone, to approximately 3 feet above the screened portion. A minimum 3-foot thick bentonite plug will be placed directly above the filter pack. The remaining annular space will be filled with a bentonite-cement grout (Volclay Grout™) to within 5 feet of the surface. The remaining 5 feet of annular space will be filled with concrete to surface grade where a traffic-rated well cover will be installed. Following a sufficient period of time for the concrete to cure, an elevation at the wellhead will be established by a licensed surveyor.

6.0 Development and Sampling of Groundwater Monitoring Wells

Following their installation, the groundwater monitoring wells will be developed, purged, and sampled using the following methods:

6.1 The monitoring wells will be developed by pumping groundwater (i.e., purging) and surging, if necessary, until water containing negligible sediment is recovered. Purged groundwater will be stored on-site in DOT 17H 55 gallon drums until laboratory analyses are obtained in order to assess its disposal classification. *NPC* will be responsible for the secure containment, storage, and proper disposal of this water. However, for an additional fee specified in a written proposal, change order, or contract, *SEC* can coordinate disposal operations.

6.2 Groundwater samples will be obtained from each monitoring well after purging the well of at least four well volumes or until the recovered water contains negligible suspended sediments, and parameters of temperature, pH, and conductivity have stabilized. Water samples will be collected with a Teflon™ bailer (or a CRWQCB/LA agency specified device), placed in volatile organic analysis (VOA) vials and other appropriate containers, kept chilled with "blue-ice", and delivered to the contract laboratory under chain-of-custody procedures. A detailed description of *SEC* well development, purging, and sampling protocols is included in Appendix A.

7.0 Laboratory Analysis of Soil Samples

The seventh task of this workplan consists of State DOHS certified analytical testing of the soil samples collected during the placement of the soil borings. At a minimum, the CRWQCB/LA requires that all soil samples be analyzed by Environmental Protection Agency (EPA), Method 418.1 (total recoverable petroleum hydrocarbons), EPA Method 8010 (halogenated volatile hydrocarbons), and EPA Method 8020 (volatile aromatic hydrocarbons). Preliminary on-site analyses for Method 418.1 parameters by a mobile lab is suggested to generally assess the verified extent of hydrocarbon contamination and further direct the drilling operations. EPA practical quantification limits of 5 to 10 micrograms per kilogram for selected volatile organic compounds are required, and even lower limits may be specified for Methods 8010 and 8020.

During our review of two previous Preliminary Site Assessment reports conducted by Dames Moore in 1988 and 1990, we identified two lists of chemical compounds that have been used or stored on the site. In addition, the presence of several other chemical compounds were noted in the texts and the hazardous materials inventories of the reports (see Appendix B). Accordingly, the CRWQCB/LA requirements for soil samples analyses may have to be amended to incorporate the methodology as discussed below.

The laboratory we recommend for analytical testing (i.e., Curtis and Tompkins, Ltd. of Los Angeles, CA) reviewed the Appendix B information on August 25, 1992. Due to the potentially complex nature of the compounds being evaluated and the possible complex nature of the matrix involved, it was recommended that a C & T Level II package be generated for this project. The Level II package includes all supporting documentation such as raw data for method blanks, matrix spike/matrix spike duplicates (or matrix spike and sample/sample duplicate data in the case of metals and inorganic parameters), laboratory control spikes, and the samples themselves.

Due to the complexity of this project, the following points need to be taken into account:

- Pure product of the oils (i.e., hydraulic oil, base oil, etc.) need to be obtained for quantification purposes. If these products cannot be obtained, accurate quantification is not possible using the LUFT procedures and method 418.1 is recommended.

- This project cannot be performed on a RUSH basis. Due to the non-standard compounds involved, some methods development work will need to be done which will require a significant commitment of time. C & T must be notified a minimum of two weeks prior to initiation of this project.

Table 1 provides the recommended analytical scheme for the compound reported.

TABLE 1.
RECOMMENDED ANALYTICAL SCHEME

Analytical Method	Compound(s)/Parameter
LUFT TEH (Total Extractable Hydrocarbons)*	Hydraulic oil Base oil Lacquer thinner Pella Oil
EPA 8015 (direct injection)	Methanol
EPA 8240 (capillary column plus library search)	Tetrahydrofuran 1,1,1-Trichloroethane Methylene chloride Toluene Trichloroethene Styrene Acetone Methyl isobutyl ketone (4-methyl-2-pentanone) Methyl ethyl ketone (2-butanone)
EPA 8270 (plus library search)	Bis-phenols/epichlorohydrin resin** tert-butyl glycidyl ether** Methylmethacrylate** Acrylic resin** Polymer resin** Epoxy resin** Polyester resin** Phthalates
GC/FID***	Cellosolve acetate (glyci)doxyproplytrimethoxysilane
GC/TSD***	Diethylenetriamine
LC***	Benzoylperoxide Tertiary butylperbenzoate
EPA 6010 (ICP)****	Cadmium
EPA 353.2	Nitrate
EPA 9045	pH

Camp Dresser & McKee Inc.

TABLE 1. (Continued)
RECOMMENDED ANALYTICAL SCHEME

* Pure product of the oils (e.g., hydraulic oil, base oil, etc.) need to be obtained for quantitation purposes. If these products cannot be obtained, accurate quantitation is not possible using the LUFT procedures and Method 418.1 is recommended.

** When specific standard are unattainable for these parameters, quantitation will be performed using the GC/MS library search.

*** No standard, approved EPA method exists for the analysis and quantitation of this compound.

**** Other T26 metals may also be evaluated by this method. If arsenic, selenium, lead, or thallium are of interest, the appropriate 7000 series method should be used for analysis.

- If quantitation of cellosolve acetate, (glyci)doxypropl-trimethoxysilane, diethylenetriamine, benzoylperoxide, and tert-butyl perbenzoate is required, C&T will have to subcontract these analyses. The cost for these compounds will be approximately $1,900/sample for the first sample and approximately $750/sample for any additional samples. Additional information/clarification of (glyci)doxyproply-trimethoxysilane is needed to order the appropriate standard against which quantitation could be performed.
- No suitable method exists for analysis of polyvinyl chloride.

The CRWQCB/LA may also require that soil samples be analyzed by other analytical methods. We will request that they provide written comments after their review of the submitted work plan. Based on the laboratory recommendations, some of the chemical compounds specified under EPA Method 8240: capillary column (i.e., Method 8260) can also be detected by a combination of EPA Methods 8010 and 8020, although the required detection limits may not be obtainable. In addition, it is our understanding that diethylenetriamine, benzoyl peroxide, and tertiary butylperbenzoate can also be detected by EPA Method 8260. Also, except for the potential for being present in the form of airborne nuisance particulates, colloidal silica, titanium dioxide, and polyvinyl chloride are relatively inert, non-hazardous compounds that do not appear to warrant analytical testing. Accordingly, we feel that although a variety of specialized (and costly) analytical methods could be employed to screen for the entire list of chemical compounds found to be associated with the site, an initial screening plan should be limited to the priority pollutants with as few methods as necessary. Furthermore, approved modifications of procedures could be used to temporarily archive certain parameters until data from other methods can be utilized to limit the number of samples to be analyzed by a particular method. As an example, Method 8270 parameters could be extracted within 7 days and analyzed within 40 days to allow a decision whether or not to run acid extractables, base- neutral extractables, both, or neither, based on other requested analytical data such as pH and Method 418.1.

8.0 Laboratory Analysis of Groundwater Samples

The water samples will be analyzed by a State DOHS certified laboratory for parameters specified by the CRWQCB/LA following a review of the soil sample analytical data, along with turbidity by EPA Method 180.1, and pH by EPA Method 150.1 as required by *SEC* protocols.

9.0 Additional "Step-Out" Exploratory Borings and Soil Sample Collection

It is possible that "step-out" borings and additional soil samples may be needed to further investigate the horizontal, as well as vertical extent of contamination. If necessary, these borings, their locations, and their depths will be finalized upon a *SEC, NPC,* and CRWQCB/LA review of the data obtained from the borings and soil sampling proposed in task 4.0. We anticipate advancing the borings to a minimum depth of 10 feet, however, if contamination is encountered, the borings may need to be extended 10 feet past last measured contamination and/or completed as monitoring wells, as discerned by field observations and measurements (i.e., which may include a DOHS certified, on-site mobile laboratory). Soil samples will be collected in five foot intervals, and submitted for laboratory analysis, as detailed in task 7.0 or as directed by the CRWQCB/LA. If the additional assessment specified in this task is requested, *SEC* can coordinate these operations for an additional fee specified in a written proposal, change order, or contract.

10.0 Preparation of Assessment Report

Upon completion of the approved tasks from 1.0 through 9.0, an investigative report will be prepared which presents our findings and an assessment of site conditions. The report will include site plans, boring logs, laboratory results, a discussion of the investigative methodology; and our findings, conclusions, and recommendations with respect to the proposed assessment investigation.

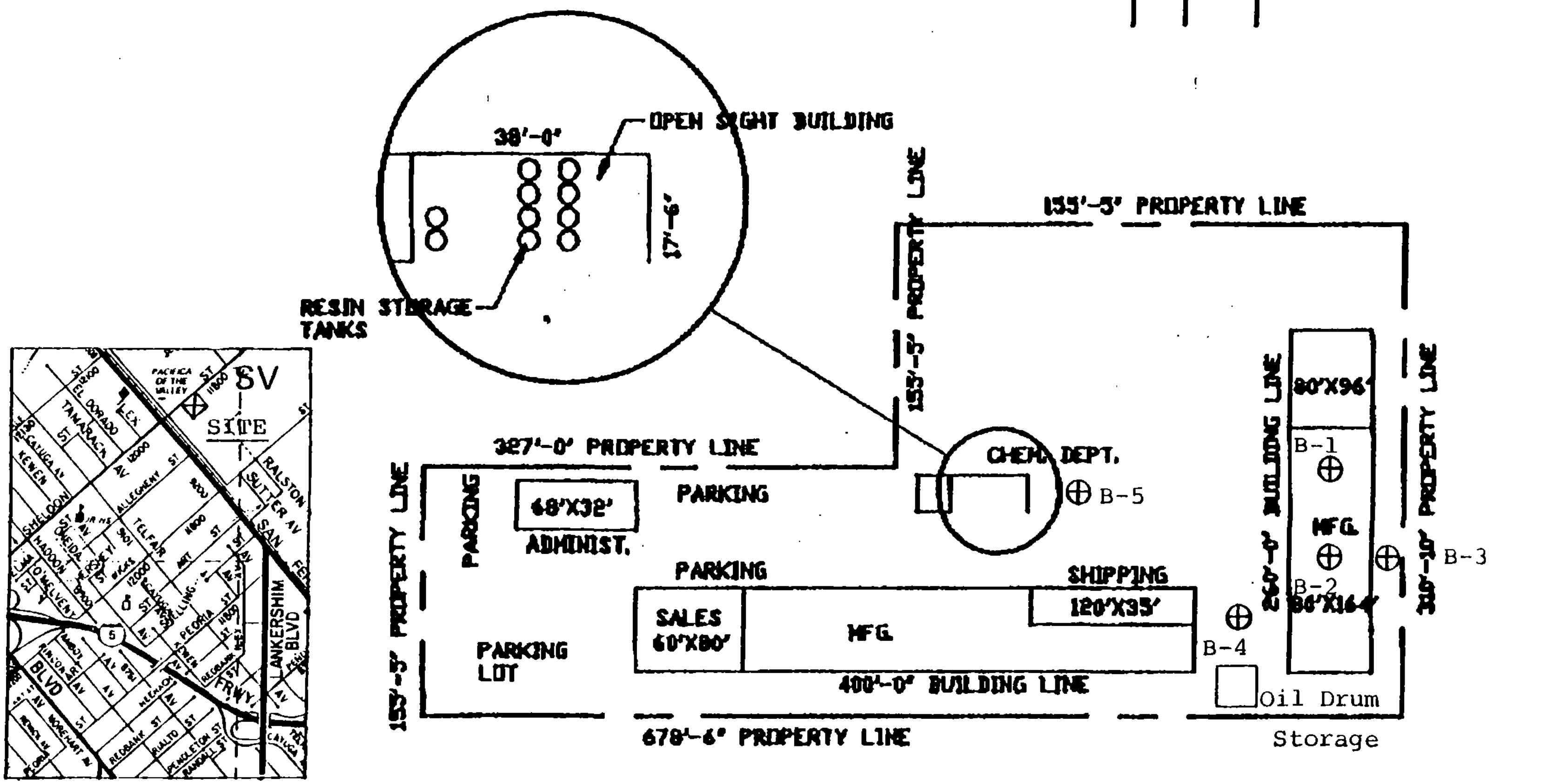
11.0 Signatures

This workplan and its associated scope of work have been developed by formally educated and trained geologic personnel according to the environmental engineering protocols generated by *SEC*. This workplan has been reviewed by the undersigned.

Project No. A3459.00
Nupla Plastic Corporation
11912 Sheldon Street
Sun Valley, CA 91352

Lawrence L. Neuvirth
California Registered
Geologist #4877

LT	ECO	DESCRIPTION	DATE	APP
NEW		INITIAL RELEASE		



T.BROS.PAGE 9 C5

⊕ Approximate location of proposed exploratory soil borings

NOTES(UNLESS OTHERWISE SPECIFIED)

ITEM NO.	QTY REQD	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION	MATERIAL SPECIFICATION

PARTS LIST

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ARE
FRACTIONS ± DECIMALS .XX± .XXX± ANGLES ±

MATERIAL

FINISH | HEAT TREAT

WEIGHT

CONTRACT NO.

APPROVALS	DATE
DRAWN	
CHECKED C.CUMMINS	08/25/92
ISSUED	
DRAFT	
ENGR	
MFG	

NUPLA CORPORATION
11912 SHELDON STREET SUN VALLEY, CALIFORNIA

PLOT PLAN

PART NO.	SIZE	DWG. NO.	REV
	A	500-034	B

SCALE | DO NOT SCALE | SHEET 1 OF 1

FIGURE 1

APPENDIX A

SEC SOIL AND GROUNDWATER SAMPLING PROTOCOLS

PRE-FIELD PROTOCOL

Active Leak Testing, Inc. (ALT) will implement the following pre-field procedures to the extent practically possible for upcoming field activities involving digging, excavation, or boring into the subsurface. These practices will be performed under the direction of a State of California Registered Geologist, Certified Engineering Geologist, or Registered Civil Engineer.

The following prefield procedures or guidelines are provided:

GENERAL FIELD PREPARATION

1. Field activities will generally be conducted based on a client and regulatory approved work plan. This work plan will be financially authorized prior to commencing any major expenditures or any field activity at this site. Deviations from this policy will be in concurrence with a registered professional and officer of the company.

2. To the maximum extent practical, the field engineer or geologist will obtain legal descriptions including Assessor's Parcel Number of the property or project site(s). At a minimum, the field engineer or geologist will obtain a site address, mailing address including zip code, a Thomas Guide page number and grid coordinates, and street names which bound the site prior to any prefield site visit.

3. If the client is not the property owner and/or lessee, a written clearance to drill or dig from the property owner and lessee(s) will be obtained prior to conducting subsurface activities.

4. All subsurface activity beyond the site boundaries will be authorized by ALT INC. and the appropriate property owner and/or lessee in writing prior to site work. The authorization will be in the form of legally authorized "right of entry" form. Any additional requirements of the property owner and client will be attached to this form.

5. Where possible, the field engineer or geologist will also obtain a site map or maps with any underground piping or wiring from the client, property owner, or lessee prior to a prefield site visit. If not much subsurface information on the site is available, the field engineer or geologist will call the city or county fire department to identify the presence of any permitted underground tanks on the site. If the fire department is not responsible, the field engineer or geologist will attempt to contact the agency responsible for registration and supervision of underground tanks for more information.

6. A pre-field site visit will be conducted by the field engineer or field geologist, the Health and Safety Officer (H&SO) and the draftsman where maps are required and any other appropriate site personnel prior to site activities involving subsurface "digging". These project personnel will perform a reconnaissance to evaluate or identify at a minimum; 1) if the site is easily accessible to large trucks or 2) if other limiting safety, access or site conditions exist; 3) client traffic patterns, and timing of client or delivery operations involving access ways; 4) problems involved with storage areas, railroad right of ways, building or property line standoffs and footings; 5) the location of overhead and underground lines, and other apparent or visible obstructions to field activities.

7. A "list" of conditions which will create or potentially create these safety or scheduling problems will be developed by the field engineer or field geologist, prior to site activities.

8. A Site Safety Plan (SSP) will be prepared by the HSO after the pre-field visit and prior to conducting any planned field activities. The SSP will be reviewed with and signed by all assigned site personnel prior to conducting any field activities. All equipment specified in the SSP for use or potential use at the site will be obtained by the field engineer or geologist or HSO prior to conducting field activities. Each assigned site personnel will be responsible for familiarizing themselves with the location of the quickest route to the nearest emergency room and/or hospital.

9. Should drilling or other field activities be required on a street, the city or county engineering office and/or Cal Trans (as appropriate) will be notified by the field engineer/geologist. The field engineer or geologist will obtain written permission for access and field activities from the agency or agencies. These agencies will stipulate the type of barricades or other markers for traffic control. These stipulations will be incorporated into the field plan and activities conducted at the site.

Without written permission from the city, county, and/or Cal Trans as appropriate, drilling or other field activities on a public street will not be conducted.

10. Should the site be in a busy public area or adjacent to a busy street, the field engineer or geologist will take crowd control and traffic control measures. These measures will be implemented in conjunction with the SSP. The site will, at a minimum, be roped off using "caution" tape and bystanders prevented from accessing the field area.

11. The field engineer or geologist will establish a list of telephone numbers for all regulatory agencies involved. Site-specific permits and/or application numbers which may be required to initiate and conduct drilling, or other field activities at the site, will also be listed. Client names and telephone numbers will also be placed on this list.

12. Required permits will be obtained prior to conducting any field activities and will be maintained at all times on site by the field engineer or geologist during field activities. On request, these permits will be available for inspection by regulators.

13. To the extent practical and predictable, the field engineers or geologist will also make adequate preparations to prevent possible hazards from affecting the field program (i.e. drilling into underground lines, lightning, heat stroke, etc). This will be accomplished by following the "Precautionary Activities & Procedures" section of this plan and by either obtaining additional equipment or by rescheduling the site work at a minimum.

PRECAUTIONARY ACTIVITIES & PROCEDURES

1. In order to avoid damage of underground lines during field activities, Underground Service Alert (USA) will be called prior to drilling, trenching, excavation or conducting any subsurface "digging" activities. USA can be contacted at 1-800-422-4133 and represents many but not necessarily all utility and oil companies that may have underground lines in the vicinity of the site.

2. The field engineer or geologist generally will call USA at least three (3) working days, but not less than two (2) working days or 48 hours prior to conducting any subsurface "digging" activity. The field engineer or geologist will provide, the Thomas Guide page number and grid coordinates, and street names to help USA to identify additional potential underground lines. USA will call these companies to identify a no-conflict situation.

3. As required, the field engineer or geologist will arrange to meet utility company representatives at or near the site to mark approximate locations. Companies that have underground lines and have not responded to USA by phone to confirm line locations, will be called by the field engineer or geologist. The field engineer or geologist will then document in writing the time, date, person and company contacted and information discussed.

4. Once potential underground obstructions have been identified from available maps and based on information gained from Underground Service Alert, the location of potential on-site obstructions will be verified. This will be accomplished as appropriate by a geophysical survey and/or by physically probing or hand-augering ahead before any excavation, drilling, or other subsurface "digging" activities are conducted.

5. A surface geophysical survey will be performed as required for safety considerations in the area of any tanks, piping and conduit. The locations and surrounding areas which have been cleared geophysically will be marked prior to drilling or other subsurface field activities.

6. Individual well or boring locations and potential stepouts will also be cleared, by a geophysical survey and by probing and/or hand augering ahead, where there is a potential safety concern. At a minimum, a (< 1") diameter hole will be cored through the existing concrete or asphalt pavement at the desired boring location. The subsurface material will be probed ahead with a metal rod, to a minimum depth of five feet.

7. If required by a client or if an underground tank or lines or any man made obstructions are present and could reasonably present high environmental, safety, or health risk, a larger hole will be hand augered ahead to reduce these risks. Surface pavement will be cut, large enough to allow the hand auger access. The subsurface will be probed ahead with a metal rod and then hand augered to a minimum depth of 5 to 6 feet. As required, a hole may be hand augered to a greater depth.

8. The HSO in conjunction with a registered professional and any officer of the company will be informed on any decision to eliminate a geophysical survey, or to probe ahead and to hand auger at each proposed location. Each will concur with the decision not to run the survey (or probe ahead and hand auger ahead), or the survey or these other field activities will be performed.

9. Where the client can not authorize the survey, and accurate facility maps of underground lines are not available, a signed release of liability will be obtained from the client by the field engineer or geologist. The final engineering decision to proceed with field activities under these conditions will be based on good environmental engineering practices and the judgement of the field engineer or geologist, a registered professional and an officer of the company.

FIELD PROTOCOL

Active Leak Testing, Inc. (ALT) will implement the following field procedures to the extent practically possible. The purpose of the field procedures will be to create a uniform approach for drilling, logging, and sampling and to provide field quality control.

The following field procedures and guidelines are provided:

EXAMPLE

FIELD PROTOCOL

Active Leak Testing, Inc. (ALT) will implement the following field procedures to the extent practically possible. The purpose of the field procedures will be to create a uniform approach for drilling, logging, and sampling and to provide field quality control.

The following field procedures and guidelines are provided:

1. "Augured Borings";
2. "Logging";
3. "Field Screening of Samples"'
4. "Sampling"; and
5. "Soil Sampling Intervals"

AUGERED BORINGS

1. Drilling will be conducted under the direction of a State of California registered professional (R.G.; C.E.G.; or R.C.E.) who is experienced in the use of the Unified Soil Classification System. Under most circumstances, a field engineer or geologist, under the direction of one of these State of California registered professionals, will supervise the actual drilling activities and procedures so that the field work is conducted in an environmentally sound and regulatory correct manner and that no unnecessary risks are taken during these activities.

2. All local, county and state permits required for proposed borings will be obtained prior to advancing these borings.

3. The Health and Safety Officer (H&SO) or his designee will have the authority to enforce that proper safety equipment is worn at all times while drilling when within the security zone. The HSO will also have the authority to enforce that field activities are conducted in a safe manner, which follow the Site Safety Plan (SSP). The H&SO or his designee will be responsible that the safety equipment is maintained in good working order and calibrated daily as specified by the manufacturer and as required by any applicable regulation.

4. Soil borings will be advanced by a method that minimizes introduction of foreign fluids while maintaining borehole stability. For unconsolidated formations, the preferred method will be hollow stem auger. This method will be implemented to the maximum extent possible in most drilling programs.

5. Most soil borings will be advanced by truck mounted drilling rigs utilizing 6" to 12" continuous flight, hollow stem augers. The size of the auger used will depend on the purpose of the boring (i.e. whether or not the hole will be backfilled or used as a well). Smaller size augers will be generally used due to economics when the hole will be backfilled rather than completed as a well.

6. Should a subsurface obstacle be encountered while advancing the boring, the boring will be halted, the auger will be removed and the soil will be probed ahead for indication of piping or tanks, etc. If the nature of the object is not apparent, the hole will be abandoned. The boring will then be relocated nearby and redrilled as required.

7. The field engineer or geologist will maintain a boring log to document descriptions of the lithology penetrated during drilling as described in the "Logging" section of this plan. Changes in lithology will be noted and soil types will be described utilizing the Unified Soil Classification System (USCS).

8. Soil sampling will be conducted following specific objectives for the project, and generally described under the "Sampling" section of this plan.

9. When soil contamination is encountered while using an onsite laboratory, the boring will continue under most circumstances to a minimum depth not less than 10 feet beyond the last detected contamination. Preferably under these field conditions, the boring will terminate approximately 20 feet beyond the last indication of contamination. Soil borings will continue to the extent practically possible at least 20 feet beyond the last detected contamination where an onsite lab is <u>not used</u>, and an Organic Vapor Analyzer (OVA) is used to give an indication of the extent of vertical contamination.

10. A soil boring may be discontinued prior to reaching this projected depth (of 10 to 20 feet beyond the last detected contamination) if groundwater is expected to be encountered at shallower depths. The basis for terminating drilling activities under these conditions, will be onsite well data or well data that can be projected from reasonably nearby wells and 2) if a groundwater monitoring or remediation well is not beneficial to the objective of the investigation or within the agreed on scope of work or contingencies by the client.

11. Where the boring can be usefully converted to a monitoring or remediation well, the design and installation will be performed based on good environmental engineering practice and based on regulatory driven practices as described in the "Well Design and Installation Protocol" section of the procedures.

12. When groundwater is unexpectedly encountered, the boring will be discontinued unless the boring has been designed as or can be usefully converted to a groundwater monitoring well or groundwater extraction (remediation) well.

13. Drilling in a saturated section beyond 5' into a tight clay layer will be discontinued under normal circumstances. Where drilling is discontinued under these circumstances the hole will be plugged back to surface with bentonite and/or bentonite grout. Where drilling is continued under these circumstances, the well design will provide adequate protection from potential cross contamination. The well design will be approved by a registered professional prior to implementation.

ROTARY BORINGS

1. Field work will be conducted under the direction of a California State registered professional (R.G.; C.E.G.; or R.C.E.) and who is experienced in the use of the Unified Soil Classification System under most circumstances, a field engineer or geologist, under the direction of one of these State of California registered professionals, will supervise the actual drilling activities and procedures to insure that the field work is conducted in an environmental sound and regulatory correct manner and that no unnecessary risks are taken during these activities.

2. All local, county and state permits required for proposed borings will be obtained prior to advancing these borings.

3. The Health and Safety Officer (H&SO) or his designee will have the authority to insure that proper safety equipment is worn at all times while drilling within the safety zone, and to insure that all field personnel conduct field activities in a safe manner that follows the site safety plan. The H&SO will be responsible that the safety equipment is maintained in good working order, and calibrated daily and as specified, by the manufacturer, and as required by any applicable regulation.

4. Soil borings will be advanced by a method that minimizes introduction of foreign fluids while maintaining borehole stability.

5. Air rotary will be the preferred method for hard consolidated formations, although water or mud rotary methods may be utilized where necessary. If a method which introduces drilling fluid into the formation is required, then a sample of the fluid will be retained. The amount of fluid forming introduced to the formation will be recorded on the field log.

6. Should a subsurface obstacle be encountered the boring will be halted, the drill pipe will be removed, and the soil will be probed for indication of piping or tanks etc. If the nature of the object is undeterminable, the hole will be abandoned. The boring will then be relocated nearby and redrilled as required.

7. The field engineer or geologist will maintain a boring log to document descriptions of the lithology penetrated during drilling as described in the "Logging" section of this plan. Changes in lithology will be noted and soil types will be described utilizing the Unified Soil Classification System (USCS). Attached is a boring log which will be used during the field program.

8. Soil sampling will be conducted following specific protocol for the project, and generally described under the "Sampling" section of this plan.

9. When soil contamination is encountered while using an onsite laboratory, the boring will under most circumstances continue to a depth not less than 10 feet beyond the last detected contamination. Preferably under these field conditions, the boring will terminate approximately 20 feet beyond the last indication of contamination. Soil borings will continue to the extent practically possible at least 20 feet beyond the last detected contamination where an onsite lab is <u>not used</u>, and an Organic Vapor Analyzer (OVA) is used to give an indication of the extent of vertical contamination.

10. A soil boring may be discontinued prior to reaching this projected depth of 10 to 20 feet beyond the last detected contamination if groundwater is <u>expected</u> to be encountered at shallower depths. The basis for terminating drilling activities under these conditions, will be: 1) onsite well data or well data that can be projected from reasonably nearby wells; 2) if a groundwater monitoring or remediation well is not beneficial to the objective of the investigation or within the agreed on scope of work or contingencies by the client.

11. Where the boring can be usefully converted as a monitoring or remediation well, the design and installation will be performed based on good environmental engineering practice and based on regulatory driven practices as described in the "Well Design and Installation Protocol" section of the procedures.

12. When groundwater is unexpectedly encountered, the boring will be discontinued unless the boring has been designed as or can be usefully converted to a groundwater monitoring well or groundwater extraction (remediation) well.

13. Drilling in a saturated section beyond 5' into a tight clay layer will be discontinued under normal circumstances. Where drilling is discontinued under these circumstances the hole will be plugged back to surface with bentonite and/or bentonite grout. Where drilling is continued under these circumstances, the well design will provide adequate protection from potential cross contamination. The design will be approved by a registered professional prior to implementation.

SAMPLING

1. During the drilling process, relatively undisturbed soil samples will also be collected for visual description, chemical analysis (and physical parameters where required) with a split barrel core sampler (modified California Drive sampler, split spoon sampler or a Shelby tube).

2. Generally two to four 2" to 2 1/2" OD x 6 inch long clean cylinders (depending on the length and size of the sampler) will be placed end to end inside the sampler. The cylinders will generally be composed of brass except where the brass could potentially interfere with the chemical analyte of concern (when analyzing for copper for example). Stainless steel tubes or other suitable materials will be substituted under these circumstances. The field engineer or geologist will make sure there is adequate supply of clean cylinders available for the job.

3. The modified sampler will be attached to the end of a drive hammer, lowered through the hollow stem auger flights and driven 12" to 24" by raising and dropping a 140 pound drive weight 30". Blow counts will be recorded on the field log.

4. After the sampler is driven to the desired depth and retrieved, the rings will be removed. To the maximum extent possible, headspace will not be allowed in the cylinder (or cylinders) submitted for chemical analysis. Other sample procedures will be in accordance with acceptable practices set by federal, state, and local agencies and as described in the "*ALT* QA/QC Protocol" section of this plan.

SOIL SAMPLING INTERVALS

1. Soil samples will be collected for chemical analysis and lithologic properties where appropriate. The frequency of chemical sampling and depths of collection will vary based on local and county regulations. The field engineer or geologist and registered professional will be responsible for understanding appropriate local, county, and state regulations with regard to minimum required boring depths, sample frequency, placement and number of borings prior to field activities.

2. Generally, the samples for chemical analysis will be collected from at least one exploratory or assessment boring near the underground storage tank and dispenser area (collective area) to at least 40' below grade, where soil contamination does not dictate further sample collection.

3. Chemical sampling beneath product pipe lines will generally be to depths of 20' or less below grade, every 20 feet along the pipeline and near the dispensers where soil contamination does not dictate further sample collection.

4. Samples will normally be recovered from borings at five foot intervals, from 5' below grade to 20' below grade. From 20' below grade through to total drilled depth, samples will be generally collected at 10' intervals, and at the termination of the boring. For example, to the maximum extent practical, for a boring advanced to 55', soil samples will be collected from intervals at 5', 10', 15', 20', 30', 40', 50' and 55' below grade.

5. The soil sampling intervals may be varied to include additional intervals based on: a) the field engineer's or geologist's observations of a significant change or changes in lithology, or; b) if contamination or groundwater is encountered, or c) local, or county or state requirements.

6. Where groundwater is encountered, sample collection will be attempted to the extent practical near the top of water and 5' intervals thereafter to the terminus of the boring.

FIELD SCREENING OF SAMPLES

1. As the boreholes are being advanced and as samples are being obtained, a organic volatile analyzer (OVA) will be used to detect: 1) the presence of volatile organics; and 2) if there are changes in concentration of volatiles emanating from the borehole. Sample selection for laboratory analysis (and for compositing where permitted) may be based in part on the vapor concentration readings and/or regulatory requirements. Field screening of samples therefore will be based on an instrument that is working correctly or properly calibrated.

2. The field engineer or geologist will be responsible to see that the instrument has been calibrated by the manufacturer or according to the manufacturers specifications at intervals specified by the manufacturer. The field engineer or geologist will also be responsible to see that: 1) the instrument is calibrated daily prior to field use; 2) a calibration gas that is appropriate and relevant to the investigation has been used; and 3) that there is an adequate supply of calibration gas on hand and at the site prior to and during the investigation. At least one OVA will be calibrated with hexane to comply with SCAQMD rules and regulations where appropriate, relevant and applicable.

3. To the extent practical, the uppermost 6 inch soil (core) sample recovered at each sampling interval will be extruded immediately in the field and placed in a glass jar, Whirl-Pak or equivalent plastic bag for the field screening of volatile organics.

4. When utilized for soil sampling screening purposes, the glass jar will be sealed with aluminum foil or teflon and fitted with an air tight lid. If plastic bags are used for screening purposes they will be sealed tight.

5. Where practical and to the extent reasonable the soil sample will then be exposed to the direct sunlight for 10 minutes or longer. The lid will be removed and the aluminum foil punctured or the plastic bag will be punctured or opened and the OVA probe will be inserted into the headspace. The jar or bag sample will then be screened for indications of possible soil contamination.

6. The background concentrations at the site and time will also be recorded on the boring log, 1) prior to any daily activity, 2) at the conclusion of that daily activity; and 3) every time a new supply of calibration gas is required for field use. 4) when the instrument is shut off and restarted later during the day.

7. OVA readings will be taken for each recovered sample. The values and at the time the sample was collected will be recorded on the boring log for the appropriate depth.

8. Based on the need to target compounds of concern not readily detected by the field OVA, such as EPA Method 8010 compounds, additional direct reading detectors (i.e. Draeger or SKC type tubes) or different calibration gases may also be utilized.

SAMPLE DOCUMENTATION AND CHAIN OF CUSTODY RECORD

1. A sample identification system will be developed for the investigation. Each sample or set of samples shipped or transported to an onsite or offsite lab will be assigned respectively, a unique number or unique numbers. These unique sample number(s) will be included on chain of custody forms and sample containers.

2. A Chain of Custody will be completed for the samples to be analyzed onsite, samples kept for potential later duplicate analysis, and samples planned for offsite analysis where applicable. These forms will be completed initially at the site by field personnel. For all samples, field personnel will record the sample number, date, and time of sample collection, type of sample, type of analysis to be performed, number of containers filled and preservation method used. A typical Chain of Custody form is attached.

3. The field engineer/geologist will also indicate the required detection limits for each analyte, the laboratory turn around time required, and the name of the person to contact for more information on that project.

4. The laboratory will maintain the samples, under appropriate DHS guidelines or appropriate EPA-SW846 methods, after being relinquished by the field engineer or geologist.

5. Where an onsite laboratory is used in conjunction with a stationary laboratory, the onsite mobile laboratory will maintain custody of samples planned for stationary lab analysis. The samples will be maintained under EPA SW846 guidelines during the inter-laboratory transfer and subsequent analysis.

6. Chain of custody forms will travel with the sample containers. All transfers will occur by properly documented and completed chain of custody form, traceable from the time of collection.

SOIL SAMPLING EQUIPMENT DECONTAMINATION PROCEDURES

1. All sampling equipment will be decontaminated before sampling. Proper decontamination of sampling equipment and drilling equipment is essential to prevent cross contamination of samples.

2. Steps to minimize surface contamination during decontamination procedures will be implemented. This will include covering the surface of the working area with plastic.

3. Before delivery to the site, the sample tubes and sampling equipment will be: 1) cleaned with a brush, "Omni Clean"™, or other equivalent and regulatory approved cleanser and tap water wash; 2) rinsed thoroughly with fresh tap water; and 3) final rinsed with distilled water and air dried. Alternatively, this equipment will be washed and dried onsite using these methods before any field use. A rinse blank may be obtained based on the objectives of the field program, and good engineering practice.

4. When the sampler is recovered from each sample interval, it will be disassembled in a clean working area to avoid cross contamination. Care will be taken to avoid or minimize contamination to extent practically possible to both the inside and outside of the cylinder and its contents.

5. Before use in the next sampling interval, the sampler will be washed onsite with "Omni Clean"™ or equivalent and regulatory approved cleanser, rinsed with clean tap water and final rinsed with distilled water. The sampler will then be re-assembled in a clean working area to avoid contamination.

6. The augers will be steam cleaned before delivery to the site and between onsite borings. Water used for steam cleaning will be obtained from the local drinking water supply or will be made up of clean water supplied by the driller. Alternately, a separate set of precleaned augers may be used for each boring.

7. Any drilling equipment that may contact the sample, will be visually inspected for hydraulic fluid leaks or other malfunctions. If the equipment fails the inspection, it will be repaired and/or steam cleaned as appropriate.

SEGREGATION AND DISPOSAL OF CUTTINGS

1. To the extent practically possible during field activities, soil samples and cuttings from borings or wells showing evidence of contamination will be segregated from material not showing evidence of contamination.

2. Initial separation of drill cuttings or spoils in the field will generally be based on OVA readings, possibly other direct instrument readings and field observations. Field criteria or observations at a minimum, will include staining or discoloration of soil, iridescence on formation fluids, and odor.

3. At the conclusion of field activities, analytical testing of discrete samples from the borings (and spoils as required) will be conducted. A DHS State of California Certified laboratory, qualified to analyze each constituent of concern, will be used to perform the chemical analysis. This laboratory analytical data will be the basis to assess the proper means of disposal or treatment.

4. Prior to disposal or treatment, soil awaiting laboratory analytical results will be stored in 55 gallon DOT approved drums, end dumps, or in sealed roll-offs, or other approved containers. The selection of drums, end dumps, or roll-offs or other approved containers will depend on the quantity of cuttings generated during drilling activities, the ease of operation such as loading and container transport and the specific spacing constraints onsite.

5. The drums and/or other containers will be temporarily stored onsite while awaiting laboratory analytical results but will be removed prior to 90 days, or sooner if required by local regulations.

6. Initially while waiting for laboratory analytical results, the material will be labeled as unspecified waste material. A name and telephone number to contact for more information will be clearly evident on the label.

7. Once the laboratory analytical results have been received and prior to shipping, the drums will be relabeled as a Non-Hazardous, California-Hazardous, or RCRA-Hazardous waste as appropriate. The contents and the name of the person to contact for more information will also be indicated on each of these labels.

8. "Clean" soil (i.e. where chemicals of concern have not been detected in the cuttings/borings at method detection limits or practical qualification limits) will be disposed of in an environmentally correct manner. Generally this will be in a sanitary or Class III Landfill, or a alternately disposed of or spread onsite.

9. Of these options, disposal or spreading "clean" material onsite may be the most economic option. Prior to spreading or disposal of any "clean" cuttings onsite, written permission for these activities will be obtained by the field engineer or geologist from the lead or administrating regulatory agency and from the SCAQMD or other local agency as appropriate.

10. Where: 1) offsite disposal is the selected option; and 2) where "clean" cuttings or material have not been placed with degraded cuttings or material, discrete laboratory analysis of samples from the boring(s) will be used to assess proper means of disposal. This laboratory data will be used in lieu of any supplementary laboratory analytical data from the drum, roll-off or other container unless specifically required by the landfill.

11. Where offsite disposal of "clean" soil is the selected option, evidence of legal disposal will be provided in documentation submitted to the administering or lead regulatory agency.

12. Since field and laboratory measurements are not necessarily correlatable, and initial segregation of material will be made based on field measurements, degraded and "clean" cuttings (as determined by later chemical analytical laboratory results) could be placed in the same container. Where 1) "clean" and degraded cuttings have been placed in the same container and 2) where every discrete sample analysis for the boring(s) does not exceed acceptance levels by the Class III landfill, the laboratory analytical data will be used in lieu of supplementary laboratory analytical data. Exceptions will be based on the specific requirements of the landfill.

13. Where a Class III landfill option is considered, and where any one or more discrete boring sample(s) show levels of contamination above that generally accepted by a Class III landfill, a representative sample will be collected from the container and analyzed for constituents of concern.

14. If the soil can not be disposed of in a Class III Landfill, the soil will then be disposed of in a Class II or Class I disposal facility or alternatively stored and later treated (remediated) on site.

15. Normally, where Class II landfill acceptance levels are not exceeded by any one discrete sample from the boring, the laboratory analytical data will be used in lieu of supplementary laboratory data from the container. An exception will be where profiling is required by the landfill.

16. Where a Class II landfill option is considered and where any one or more discrete boring sample or samples show(s) levels of contamination above that generally accepted by a Class II landfill, a representative sample will be collected from the container and analyzed for constituent(s) of concern. Disposal in a Class I or Class II landfill, will be based on that representative analysis.

17. Where the offsite disposal has been selected, evidence of legal disposal and proper manifesting for Class I or Class II disposal will be provided to the lead or administering regulatory agencies.

18. Where onsite treatment or treatment prior to offsite disposal is considered, field activities will be conducted based on a regulatory approved corrective action plan (CAP). The CAP will be developed once the results of the subsurface investigations are compiled.

BACKFILLING BOREHOLES

1. To the maximum extent practical, test holes or exploratory borings not completed as wells will be backfilled immediately after drilling, but if not, within 48 hours of completion of the drilling program.

2. During periods where no work is being performed, such as overnight and where a borehole is not backfilled immediately, the boring and surrounding excavation, if any, will be covered. The cover will be sufficiently strong and anchored appropriately to prevent the introduction of foreign material into the boring and to protect the public from a potentially hazardous situation by introduction of contamination into the subsurface.

3. All abandoned test holes or exploratory borings will be backfilled in such a way that they will not act as a channel for the interchange of water or present a hazard to the safety and well being of people and animals.

4. All borings will be completely filled with sealing material from the bottom of the boring up. Placement will be by methods that prevent dilution or separation of fill material.

5. Where an aquifer has been penetrated, bentonite will be placed from the bottom of the boring to a minimum of five feet above the top of the seasonally high ground water surface.

6. Where contamination has been encountered within the boring, neat cement, cement grout, and/or concrete will be placed in the boring from the top of the bentonite seal to surface. Alternately, bentonite may be used for fill from the bottom of the boring to surface grade.

7. To assure that the boring is filled and there has been no "bridging" of material, the field engineer or geologist will determine if the volume of material placed in the hole at least equals the calculated volume of the empty hole.

8. As based on the approved work plan, one to two weeks after sealing the boring, the field engineer or geologist or their designee, will inspect the borehole(s) to determine if additional sealing materials will be required. If required and authorized, the field engineer or geologist, or their designee will take additional measures to fill the borehole to grade level.

ACTIVE LEAK TESTING, INC.
VAPOR SURVEY PROCEDURE

Vapor surveys are an economical means for initially detecting and defining the existence and areal extent of hydrocarbon contamination. Vapors, as a rule, will definitively find their way to the surface when a source for the particular vapor is available in the soil below the region of interest. The vapor distribution is, thus, an indication of the existence and location of liquid in the subsurface soils. When performed with an Organic Vapor Analyzer (OVA) in the FID mode, the measurements are exclusive of water vapors, thus, there is no interference from near surface occurrence of water or water vapors.

A vertical profile of vapor concentration will sometimes provide additional information on the variability of horizontal and vertical vapor distribution. That distribution may be affected by changes in soil permeability and composition. Since there is no definite correlation between the concentration of vapor and the concentration of liquid in the soil, a vapor survey indicates the probable location of the presence of high liquid concentration. The vapor distribution data allows the geologist to optimize the placement of discovery wells and gain the most information on the vertical extent and the vertical distribution of the liquid (and vapor) concentrations in the subsurface soils.

A vapor survey is accomplished by penetrating the surface of the property, to a depth of 18-inches, with a series of 1-inch diameter holes (vapor ports) in a predetermined pattern. Concrete or macadam pavement is penetrated by a drill fitted with a masonry bit. Locations of the vapor ports are initially designed to be spaced at 20 foot intervals bracketing tank, piping and dispenser locations.

Immediately following the drilling process, a cork is placed at the top of the vapor port and vapors are allowed to collect in the vacated space for a period of at least 15 minutes. The cork is then removed, and is replaced by another cork with an OVA probe extending 4-inches through it. This standardizing technique insures that each vapor port is tested at the same depth. Since the vapor port is sealed with a cork the OVA pump quickly evacuates the vapor port and allows the OVA to take a reading on the total quantity of vapors present. These principles allow the geologist to take accurate and standardized readings of organic vapors in all vapor ports.

The OVA readings are recorded on ALT Vapor Survey Data Sheets, and the vapor port is marked and numbered on a plot plan (to scale) of the property. High vapor concentrations can be tracked by adding vapor ports in locations suspected to show similar concentrations. Alternatively, vapor ports may be introduced at some distance from an expected source to document the absence of vapors and, therefore, demonstrate limits to the migration of the contamination. Following the initial measurement, the vapor ports are recorked to keep them available for future observations.

The data collected is mapped on a plot plan of the property. Isolines of concentration are drawn to enclose the major levels of concentration. The contour intervals may be large (say 100, 500 and 1,000 ppm) or small (say 0.1, 0.5 and 1.0 ppm) to fit the approximate scale of precision attained by the spatial separation of the vapor ports. The vapor concentration contours will generally delineate pathways of transport. The highest concentrations on the diagram may be interpreted as cores of liquid contamination.

VAPOR EXTRACTION WELL DESIGN

1. Depending on the analytical results of the initial drill, vapor extraction wells may be installed at the site. Because vapor extraction wells used in remedial clean-up programs are designed to remove contaminants from specific zones, vapor extraction wells will be designed to match the geologic setting and purpose of the wells, and will be based on good environmental engineering well practices. A State of California Registered Geologist, Certified Engineering Geologist or Registered Civil Engineer with experience in remediation, will design or will approve the well design before commencing any permitting activity.

2. All local, county, and state permits required for constructing remediation wells will be obtained prior to drilling of each well.

3. Selection of screen and casing materials will be based on: 1) contaminants to be remediated; 2) chemical reactiveness or inertness to the contaminants; 3) strength of material; 4) ease of installation; 5) cost of material; and 6) projected useful life of the remediation well. Screens will ideally be constructed from a material that is inert to the contaminated vapors being extracted. However, the cost of material and projected useful life of the remediation well will also have a bearing on the selection of materials. Unless other specifications are made by the client or regulators, generally remediation wells will generally be constructed of four inch or larger ID, schedule 40 PVC flush threaded blank and screened pipe. Solvent cements will not be used to assemble the blank and screened pipe.

4. Slot sizes will be chosen to retain the filter pack or natural formation materials under vacuum conditions. Where remediation wells will be drilled in one phase only and where there is not any information from wells on adjacent properties that indicate otherwise, the screen will be machine slotted with 0.020 inch slots. The sand pack will be #3 Monterey sand, or an equivalent washed material with grain sizes between 0.093 and 0.033 inches in diameter. Crushed rock will not be used for the filter pack.

5. A sieve analysis will be performed prior to additional or new well completion where, 1) the existing vapor extraction wells have collected significant fines and more than one phase of drilling is planned; and 2) where remediation or other wells on adjacent sites with similar lithologies have been completed properly (with 0.020 inch slots and a #3 Monterey sand or equivalent filter pack) and significant fines have collected in the well bore. The sieve analysis will be used to select the filter pack and slot size. The selected slot openings, slot design, open area and screen diameter should permit effective remediation.

6. Existing monitoring wells may be converted to vapor extraction wells where economical and suitable to the objectives of the remediation.

VAPOR EXTRACTION WELL INSTALLATION

1. When placed in the subsurface, all screens and casings used for vapor extraction (remediation) wells will be in a sterile and contaminant free condition to the maximum extent practically possible. Screen and casing will be cleaned prior to onsite activities where possible. Where not possible, steam cleaning, or a high pressure hot water spraying technique will be combined as required with a "Omni Clean"™ tap water wash and tap water rinse onsite. Cleaning will take place on plastic or in another area that will contain wash water releases. Care will be taken to effectively limit or reduce contamination of surrounding areas by release of wash water.

2. During completion activities, a cap will be fastened to the bottom of the casing. This will be accomplished by using a threaded bottom cap or alternately by placing stainless steel screws into or by popping stainless steel rivets through a slip cap into the casing. No solvent cements will be used.

3. Wells will be constructed with a minimum of two and one half inch annular pack around the outside of the PVC casing. For example, for a 4" ID (4.5" OD) Schedule 40 PVC casing, the hole diameter should be at 9.5" or greater. A ten or eleven inch diameter hole would be the preferred hole diameter.

4. The annular filter pack will extend from the base of the casing to 2 to 3 feet above the top of the screened interval. This will allow for settling of filter pack and will prevent downward migration of the bentonite or cement grout into the screen.

5. A minimum of 2 to 3 foot bentonite plug will be set above the filter pack under normal conditions.

6. Above the top of bentonite plug, which should be at a minimum of 5' below surface, the annulus will be filled with bentonite grout, or cement. From 5' below surface to surface, the well bore should be filled with cement. Bentonite grout will be used from 5' below surface to the top of the bentonite plug where the top of the bentonite plug is greater than 5' below grade.

7. Well protection will be achieved by installation of a traffic rated box where required based on traffic patterns. The box will be raised approximately 2" to 3" above the surrounding grade. This will reduce the collection of nuisance water within the well box. Wells will have internal well heads suitable to the remediation. Remediation well I.D.tags will be affixed to all wells. A Vapor Extraction Well Construction Schematic for the site is provided.

WELL CONSTRUCTION LOGS

Where water is encountered the well construction logs will indicate subsurface hydrogeological conditions at the site. At a minimum the information these logs will include:

a) first encountered groundwater and water levels after well installation and development, when available.

b) screen size and interval.

c) filter pack size and interval.

d) composition and location of annular seal.

e) drilling method description.

f) depth and diameter of borehole and casing.

g) date drilling occurred.

h) construction materials.

GROUND WATER MONITOR WELL DESIGN

1. The design of groundwater monitoring wells at this site will be based on: 1) the characteristics of the zones or strata to be monitored and the types of contaminants to be expected and 2) good environmental engineering practice. A State of California Registered Geologist, Certified Engineering Geologist or Registered Civil Engineer with five years or more experience in hydrogeology or geohydrology will design or will approve the well design before commencing any permitting activity.

2. All local, county and state permits required for constructing groundwater monitor wells will be obtained prior to drilling of each well.

3. Where hydrologically feasible, and where fluctuations of the water table are known to be, or are probably less than ten feet above the current ground water surface elevation, the top of the screens will be placed 10 feet above the groundwater surface elevation. The base of screens will be either to a competent confining clay layer at least five feet thick, or twenty feet below the top of groundwater where a competent confining clay layer is not encountered in the first twenty feet (below groundwater surface elevation).

4. Where based on regional or local data, the fluctuations of the water table are known or probably greater than ten feet above the current ground water surface elevation, or deeper than twenty feet below the current groundwater surface elevation, the screened interval will be extended accordingly. The top of the screened interval in these cases will be extended to ten feet above the seasonally high groundwater elevation. The base of the screened interval will be placed either twenty feet below the seasonally low groundwater surface elevation, or at the first encountered competent confining clay layer at least five feet thick.

5. Where the groundwater elevation or seasonally high groundwater elevation is less than 15 feet below grade, adjustments to the well design will be made on a case by case basis by a registered professional with five years or more experience in geohydrology, or hydrogeology.

6. Selection of screen and casing materials will be based on: 1) contaminants to be sampled; 2) chemical reactiveness or inertness to the contaminants; 3) strength of materials; 4) ease of installation; 5) cost of material; and 6) projected useful life of the monitoring well. Screens will ideally be constructed from a material that is inert in the contaminated fluid being sampled. However, the cost of material and projected useful life of the monitoring well will also have a bearing on the selection of materials. Unless other specifications are made by the client or regulators and where conditions are exploratory, groundwater monitor wells will be constructed of four inch ID, schedule 40 PVC flush threaded blank and screened pipe. Casing and screen materials requiring solvent cements will not be used.

7. Slot sizes will retain the filter pack or natural formation materials. For 1) exploratory wells or 2) where all wells will be drilled in one phase only, and 3) where there is not any information from wells on adjacent properties that indicate otherwise, the screen will be machine slotted with 0.020 inch slots. The sand pack will be #3 Monterey sand or an equivalent washed material with grain sizes between 0.093 and 0.033 inches in diameter. Crushed rock will not be used for the filter pack.

8. A sieve analysis will be required prior to additional well completions where the existing wells have significant fines and more than one phase of drilling is planned. A sieve analysis well also be required prior to new well completion where there are significant fines and where monitor wells on the adjacent sites have been developed properly, and are completed with 0.020 inch slots and a #3 Monterey sand or equivalent has been used as the filter pack. The sieve analysis will be used to select the filter pack and slot size. The selected slot openings, slot design, open area and screen diameter will permit effective development, and utilization of the well.

GROUNDWATER MONITOR WELL INSTALLATION

1. When placed in the subsurface, all screens and casings used for groundwater monitoring wells will be in a sterile and contaminant free condition, to the maximum extent practically possible. Screen and casing will be cleaned prior to onsite activities where possible. Where not possible, steam cleaning, or a high pressure hot water spraying technique will be combined as required with a "Omni Clean"™ or equivalent and tap water wash and tap water rinse onsite. Cleaning will take place on plastic or in an area that will contain wash water releases. Care will be taken to effectively limit or reduce contamination of surrounding areas by release of wash water.

2. During completion activities, a cap will be fastened to the bottom of the casing. This will be accomplished by using a threaded cap or by screwing stainless steel screws into or alternately by placing stainless steel screws into or by popping steel rivets through a slip cap into the casing. No solvent cements will be used.

3. Wells will be constructed with a minimum of two and one half inch annular pack around the outside of the PVC casing. For example for a 4" ID (4.5"OD) Schedule 40 PVC casing, the hole diameter should be at 9.5" or greater. A ten or eleven inch diameter hole would be preferred hole diameter.

4. The annular filter pack will extend from the base of the casing to 2 to 3 feet above the top of the screened interval. This will allow for settling of filter pack and will prevent downward migration of the bentonite or cement grout into the screen.

5. A minimum of a 2 to 3 foot bentonite plug will be set above the filter pack under normal conditions.

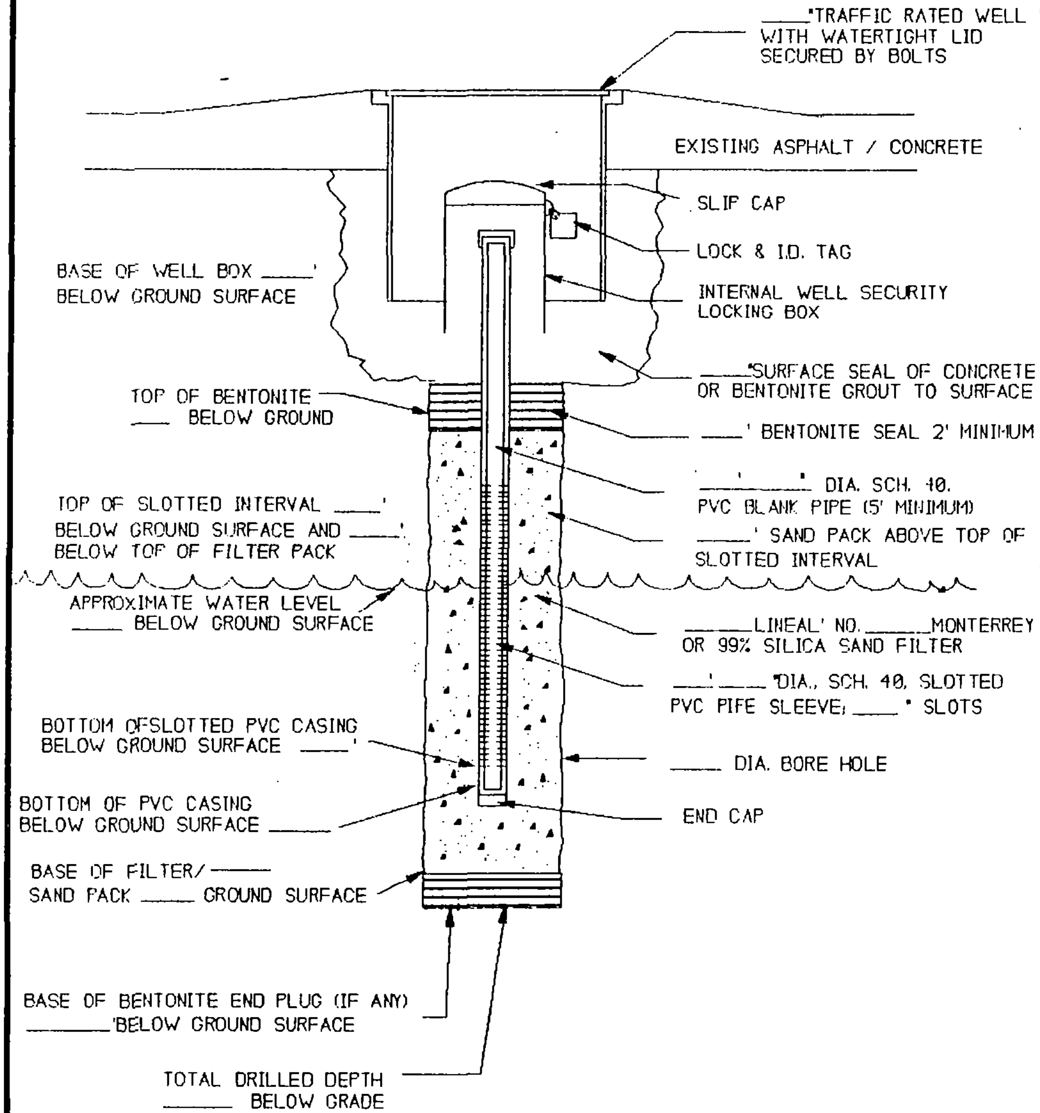
6. Above the top of bentonite plug, which should be at a minimum of 5' below surface, the annulus will be filled with bentonite grout, or cement. From 5' below surface to surface, the well bore should be filled with cement. Bentonite grout will be used from 5' below surface to the top of the bentonite plug where the top of the bentonite plug is greater than 5' below grade.

7. Well protection will be achieved by installation of a traffic rated box, where required based on traffic patterns. The box will be raised approximately 2" to 3" above the surrounding grade. This will reduce the collection of nuisance water within the well box. All monitoring wells will also have an internal protection device. The wells will have top slip caps in addition to the internal locking box. Monitoring well I.D.tags will be affixed to all wells. A groundwater Monitor Well Construction Schematic for the site is attached.

WELL CONSTRUCTION LOG

CLIENT REPERESENTATION ______________
CLIENT NAME: ______________
SITE MANAGER: ______________
CLIENT LOCATION ______________

WELL NUMBER: ______________
WELL LOCATION: ______________
SURFACE ELEVATION: ______________
(FT ABOVE MSL)
DATE: ______________



DRILLING SUMMARY

TOTAL DEPTH OF BORE (FT): ______________
BOREHOLE DIAMETER (IN): ______________
DRILLING COMPANY: ______________
DRILLING FOREMAN: ______________
RIG NUMBER: ______________
LOGGED BY: ______________

CONSTRUCTION TIME LOG

	START DATE	START TIME	FINISH DATE	FINISH TIME
DRILLING:	____	____	____	____
GEOPHYSICAL LOGGING:	____	____	____	____
SCREEN PLACEMENT:	____	____	____	____
FILTER PACK PLACEMENT:	____	____	____	____
SEAL PLACEMENT:	____	____	____	____
GROUTING:	____	____	____	____
DEVELOPMENT:	____	____	____	____

WELL CONSTRUCTION MATERIAL

	GROUT	SEAL	FILTER PACK
QUANTITY:	____	____	____
TYPE:	____	____	____

CASING

TYPE: ______________
SIZE: ______________
MANUFACTURE: ______________

SCREEN

SIZE: ______________ CONFIG: ______________
AREA / FT.: ______________ PERF OR SLOT SIZE: ______________
INSIDE DIAMETER: ______________
MANUFACTURER: ______________
JOINTS & CENTRALIZERS: ______________

COMMENTS: ______________

GROUNDWATER MONITORING WELL DEVELOPMENT PROTOCOLS

1. The water levels in all wells on a site will be measured before any well development activities are initiated. The depths to the bottoms of the well casings or the upper extents of sediment (near the bottoms of the casings) will also be recorded.

2. Prior to well development and with as minimal disturbance as practically possible, bailer samples will be obtained from the well bore near the top (especially for floating product), middle, and bottom of the water column, respectively. These samples will be used as necessary to initially assess turbidity, pH, temperature, conductivity, and possible types of contamination. In general, discovery of free product in a well will be sufficient cause for initiating a review of the situation by a registered professional before proceeding with further development.

3. Where conditions are known, development operations will proceed from wells known or suspected to contain minimal contamination, to wells which are known or suspected to contain significant contamination. All sampling and development devices will be decontaminated before proceeding to other wells by utilizing decontamination procedures as specified in the "Groundwater Well Equipment Decontamination Protocols".

4. During well development activities, near bottom siphon bailing or other procedures will be implemented as necessary to remove excessive accumulated sediment from the well casing. Final bore cleanout data will be used to choose an appropriate bailing and/or pumping strategy.

5. Development operations will begin by initially setting the bailer/pump intake at approximately 10 feet below the static water level. Bailing and/or pumping will proceed for a recorded interval of no more than one minute, or when the bailer does not fill completely, or immediately when the pump first draws air. Recovery will be measured for at least 10 minutes immediately following cessation of bailing and/or pumping. Drawdown and recovery data will be used to assess the well recharge rate.

6. Depending on the known or anticipated chemical contaminants to be sampled, the selection of development equipment will be modified as necessary to include chemical compatibility. Water quality parameters will also be checked at the end of the recovery interval and appropriate water samples obtained as necessary to provide QA/QC data and/or to comply with regulatory guidelines. Recharge rate calculations and water quality assessment will be used to decide whether to continue with or change the development procedure.

7. The monitoring well recharge rate will be approximated based on a detailed review of field observations and boring logs, and appropriate development equipment will be selected as follows:

Approximate Recharge Rate	Development Device
0 - 1.0 gal/minute	Teflon/stainless steel bailer/Arch pump
1.0 - 10 gal/minute	Arch pump
10 gal/minute plus	Jacuzzi Sandhandler(10 gpm±)

8. The bailing and/or pumping procedure will be modified to minimize drawdown and continue with water removal near the top of the water column until turbidity appears to approach low levels (i.e., water appears relatively clear). This procedure will be repeated at deeper stages in the water column as specified in the attached table.

9. Development operations will remove at least four bore volumes of water (or quantity specified by a regulatory agency) from the well in approximately equal stages. An assessment of turbidity, pH, temperature, conductivity, and other parameters will be used to decide if additional development time and/or procedures are warranted.

10. Upon completion of development operations, the top of well casing elevations will be established with respect to mean sea level (MSL) by contracting the services of a licensed surveyor. The surveyor shall prepare a scaled plot plan showing the locations of the wells, well casing elevations, structure outlines, and general topography of the site.

11. Prior to any sampling activities, water levels in all onsite wells will be measured relative to casing reference marks after a regulatory agency approved stabilization period has elapsed since well installation. Unless otherwise indicated, this stabilization period will be at least 72 hours.

TABLE 1

Height of Water Column (Ft)	Development Depths in Water Column (Ft) *				
25	10	20	-	-	-
40	10	25	35	-	-
60	10	30	50	-	-
80	10	30	50	70	-
100	10	30	50	70	90

* - Assumes that monitoring wells have been installed such that the slotted casing extends at least 20 feet below the water table. Specific guidelines will be developed for monitoring wells that do not meet this criteria or that have more than 100 feet of water in the casing. Appropriate water samples will be obtained immediately after the final development and recovery, and at set intervals thereafter if acquisition of this data appears warranted or is required by a regulatory agency. All development and sampling devices will be decontaminated before proceeding to other wells by utilizing ALT's decontamination procedures.

GROUNDWATER MONITORING WELL PURGING PROTOCOLS

1. Prior to any field work, all site specific groundwater monitoring well development data will be reviewed to formulate the appropriate well purging strategy. A field review of the groundwater sample analytical data will also be required during purging operations of each well to establish and modify purging of sampling intervals for specific contaminants.

2. Water levels in all onsite wells will be measured before any purging activities are initiated relative to a licensed surveyor's reference marks. Measurement will occur after a regulatory agency approved stabilization period has elapsed since well development. Unless otherwise indicated, this stabilization period will be at least 72 hours. Measurements will include the depth to the bottom of the well casing or the upper extent of sediment (near the bottom of the casing). In general, purging operations will proceed from wells known or suspected to contain minimal contamination, to wells which are known or suspected to contain significant contamination.

3. Prior to well purging, and with as minimal disturbance as practically possible, bailer samples of the well bore water will be obtained near the top (especially for floating product), middle, and bottom of the water column, respectively. These samples will be used as necessary to initially assess turbidity, pH, temperature, conductivity, and possible types of contamination. Although "representative" samples will not be possible, sampling protocols as specified in the "Groundwater Monitoring Well Sampling Protocols" section will be implemented to properly, store, and transport water samples under chain-of-custody procedures to a state-certified analytical laboratory if such pre-purging data acquisition appears warranted or is required by a regulatory agency.

4. Near bottom siphon bailing or other procedures will be implemented as necessary to remove excessive sediment that may have accumulated in the well casing since the last stages of development. Well bore cleanout data and well construction information will be used to choose bailing and/or pumping strategy.

5. In general, purging operations will begin by initially setting the bailer/pump to remove water from the specific well at the same depth stages and rates used in the development procedures. Water quality properties, especially turbidity, will be evaluated to assess for the presence of potentially detrimental sand or chemical contaminant intake by the bailer and/or pump. Staged bailing and/or pumping will proceed until turbidity appears in general negligible and at least four bore volumes (or a quantity specified by a regulatory agency) of water have been removed. A continual record of time versus drawdown and/or recovery will be obtained during the purging process.

6. Following the purging operations, the bailer/pump will be reset at a depth of approximately 10 feet below the top of the water column. Bailing/pumping will resume until turbidity appears negligible, and pH, conductivity, and temperature have stabilized [i.e., successive readings in a 10 minute interval should be within approximately one-percent (1%) of the previous readings]. Unless otherwise indicated, once this equilibrium is reached, the well is assumed to be adequately purged for sampling.

7. All water level measuring instruments, sampling and purging equipment will be cleaned before proceeding to other wells by utilizing the decontamination procedure as specified in the "Groundwater Well Decontamination Protocols".

GROUNDWATER MONITORING WELL SAMPLING PROTOCOLS

1. Upon obtaining the required stability in field measured parameters (i.e., turbidity, temperature, conductivity, and pH) during purging, appropriate sample containers and preservation methods will be selected based on regulatory agency guidelines. Sampling operations will proceed from wells known or suspected to contain minimal contamination, to wells which are known or suspected to contain significant contamination.

2. Based on criteria most suitable for preserving the integrity of samples, a policy has been adopted of using only bladder pumps and/or Teflon/stainless steel bottom-emptying bailers to sample groundwater or free product in monitoring wells. While bladder pumps are generally the first choice for accurate sampling, the use of these devices is restricted to sites and conditions that would justify their significantly higher operating costs.

3. While quickly recharging wells can usually be sampled immediately after purging, slowly recharging wells (i.e., those installed in materials with hydraulic conductivities ranging from less than 1×10^{-6} up to about 1×10^{-5} cm/sec) should be sampled at approximately 4 hours after purging whenever practical.

4. Upon completion of the sample container preparation and the sampling device decontamination procedures, groundwater and/or free product samples will be obtained at elevations based on good environmental engineering practices. Groundwater samples will be obtained based on the "General Data Quality Assurance and Quality Control Plan" section of these protocols. Environmental Protection Agency/DHS certified, laboratory-cleaned 40 milliliter (ml) clear or amber borosilicate glass volatile organic analysis (VOA) vials with open top screw caps and Teflon-faced silicone septa, and 250 ml to 1000 ml glass or polyethylene bottles will be used unless otherwise specified. The number of containers to be used will depend on anticipated numbers of samples, sample duplicates, trip blanks, rinse blanks, and analyses required for the project. Whenever practical, all containers should be prelabelled and prechilled on blue ice for at least one hour prior to use.

5. The groundwater samples will be immediately transferred to the appropriate prelabelled and prechilled containers such that aeration is avoided to the maximum extent practical. For filling the 40 ml VOA vials, the bottom emptying device on the bailer (or discharge line from a bladder pump) should be inserted to the bottom of the glass and then raised slowly outward as the sample is introduced, and until surface tension mounding occurs at the vial opening. Careful capping at this point usually results in a sample with essentially zero headspace (i.e., no bubbles present to migrate as the vial is inverted). If zero headspace is not obtained, the vial will be emptied and refilled from the sampling device until this is accomplished. Larger sample containers may be filled in a similar fashion, although obtaining zero headspace is not easily obtainable and may not be desired or required. Samples in containers will be stored in clean polyethylene zip-lock type bags and placed in a cooler chilled with blue ice until transported to a state-certified laboratory under chain-of-custody procedures.

6. Following sampling, decontamination procedures specified in the "Ground Water Well Equipment Decontamination Protocols" section will be implemented on all equipment used.

GROUNDWATER MONITORING WELL EQUIPMENT DECONTAMINATION PROTOCOLS

1. A four-stage procedure will be utilized for decontaminating equipment used during development, purging, and sampling groundwater monitoring wells. This procedure will typically consists of a strong detergent solution wash followed by a moderately strong detergent solution wash, and a tap water (or equivalent) rinse followed by a distilled water rinse. Although solutions of pure trisodium phosphate in water have often been used as the environmental industry standard detergent for this procedure, an internal policy has been adopted to comply with new regulatory guidelines that stipulate the use of non-phosphate detergents. Accordingly, unless otherwise indicated, a non-phosphate detergent such to as Omni-Clean(R) or equivalent will be used in all decontamination procedures.

2. Items that typically require on-site decontamination include, but are not necessarily limited to drill rig operated development, purging, and sampling devices including down-hole rod and/or cables; bailers, pumps, and associated cables, pipes, and hoses; water level/product interface probes and cables; pH, temperature, and conductivity sensors; hand tools; personal protective equipment; and additional decontamination containers or equipment. Rinse blanks will be obtained in accordance with the "Groundwater Monitoring Well Sampling Protocols", if warranted or required.

3. Large development, purging, and sampling equipment, such as that transported and operated by truck-mounted drill rigs, must be steam cleaned prior to arrival on the site where it will be used. Additional decontamination of such equipment with the standard or modified procedures will be implemented if warranted or required by a regulatory agency.

4. The frequency and extent of decontamination is item specific. In general, however, decontamination must be implemented before and after each groundwater sample (or set of samples) is obtained from a particular monitoring well or other source approved by a regulatory agency. Wash and rinse solutions must be replenished as required to remain effective while working on each well site. Unless dedicated to a particular well, the wash and rinse containers and equipment must be adequately decontaminated and filled with fresh wash solutions and rinse water before proceeding to sample a new well location.

5. During the decontamination process, washing solutions and rinse water well be mixed in, stored in, and/or dispensed from previously decontaminated containers and equipment. Typical containers include, but are not necessarily limited to, 55-gallon PVC or metal drums, large diameter PVC tubs, 5-gallon PVC buckets, and various sized Pyrex or Nalgene graduated cylinders and beakers. Decontamination equipment typically includes, but is not necessarily limited to steam cleaners, high pressure washers, portable PVC sprayers, suction pumps, and hand operated scrubbing devices.

6. Decontamination procedures will include provisions for secondary containment of anticipated contaminants, as well as spillage of washing solutions and rinse waters. Unless otherwise indicated, a relatively thick layer of Visqueen with bermed edges is generally sufficient for this purpose. An absorbent material such as granular bentonite or vermiculite will be kept available at all times for additional attenuation of spills or runoff.

7. All contaminated wash solutions and rinse water, including any spilled within the secondary containment area, must be collected, segregated and stored in labelled containers in accordance with any specific regulatory agency guidelines and as indicated in the "Segregation and Disposal of Rinseate and Purged Well Water" section of these protocols.

SEGREGATION AND DISPOSAL OF RINSEATE AND PURGED WELL WATER

1. All rinseate or other fluids from sampling and analysis, and water from well development and aquifer testing will be stored onsite in 55 gallon drums or Baker type tanks, depending on the volume of well water and/or rinsate generated during the site assessment and/or remediation.

2. To the maximum extent practically possible during field activities, fluid showing evidence of contamination will be segregated from fluid not showing evidence of contamination. The quantity of water removed from each well and from tanks or drums will be documented in a field write up.

3. Initially, drums and tanks will be stored onsite while waiting for laboratory analytical results. The container will be labelled as unspecified liquid waste material. The name of a person and telephone number to contact for more information will be clearly evident on the label.

4. Once a laboratory analysis has been received, all drums and other containers will be re-labelled with the contents, name of a person to contact for more information, and an appropriate hazard warning.

5. The fluids will then be disposed of in an environmentally sound and regulatory correct manner. Disposal without approval by the client and appropriate regulatory agency will not be conducted. Evidence of legal disposal will be provided in documentation submitted to the administrating agency.

6. Where the client has established a standard profile with a landfill or with a recycler for accepting and recycling contaminated well development and purge water, these contaminated fluids will be sent to these approved facilities where economic.

7. Where a NPDES permit exists and/or can be modified, or where a new permit can be obtained, the extracted fluid may be disposed of by discharge to a storm drain if economic. This option will only be exercised on specific approval by the Regional Water Quality Control Board (RWQCB) and by the client.

8. Alternately if the fluid can be disposed of legally in the sewer system in an economic manner, disposal under this option may be exercised on specific permit approval by the local sanitation district and client.

Active Leak Testing, Inc. (ALT)/Sirrine/CWM-QA/QC PROTOCOL

Active Leak Testing, Inc. (ALT)/Sirrine/CWM will implement the following Quality Assurance (QA)/Quality Control (QC) procedures to the extent practically possible. The purpose of these procedures will be to create a uniform, environmentally sound, and regulatory correct approach for field and report QA/QC.

The following QA/QC procedures or guidelines are provided:

SOIL (CORE) SAMPLING QA/QC FIELD PRACTICES

1. Soil (core) samples collected for chemical analyses and the assessment of physical properties will be of sufficient volume to perform the designated soil analysis. Since some labs or sampling objectives may require variation from the typical amounts, the field geologist/engineer will establish the appropriate sample volume by coordination with the laboratory prior to commencing any field activities.

2. A sufficient number of appropriate containers (i.e. brass tubes, sample jars) which are pre-cleaned prior to site use or cleaned on site will be used to collect samples. Care will be taken to avoid contamination in both the inside and outside of the container and its contents during field operations.

3. Since an improperly preserved or identified sample may also negate its usefulness, the samples will be capped, labelled, maintained at air and water tight conditions and preserved according to EPA SW846 field preservation techniques.

4. Generally the two lower sample cylinders will be used for chemical analysis. Once the samples are collected, each end of the cylinder will be immediately covered with 1) aluminum foil and capped with a polyethylene plastic lid or 2) alternately a teflon lid. Care will be taken to eliminate headspace in each sample cylinder during collection. Samples for chemical analysis will be extruded from the cylinders by the analytical laboratory and not by field personnel.

5. The samples will then be taped, sealed and labelled, and placed in ziplock bags. A label and seal will be placed on each container. The label will include the following information:

   - site location
   - client name
   - boring number and depth
   - sample description/number
   - time and date of sample collection
   - sampling method
   - sampler's identity
   - type of analysis to be performed (optional)

6. The soil samples selected for chemical analysis will be preserved in the field after collection by immediate placement in an ice chest. The ice chest will be cooled to and maintained at 4°C. Dry ice, ice, or blue ice will be used to maintain the ice chest at 4°C. The samples will be maintained at this condition by the field engineer/geologist prior to delivery to a selected laboratory.

7. To the maximum extent possible, the laboratory will receive samples for analysis within 24 hours of collection. Exceptions may occur when the sample is collected at the end of the business week, and when arrangements can not be made for sample pick-up at the site or at the consulting facility or dropped off at the analytical laboratory. In these cases, samples will be received by the laboratory on the following business day.

GENERAL DATA QUALITY ASSURANCE AND QUALITY CONTROL PLAN

1. All sample analyses will be performed at State of California Department of Health Services (DHS) certified laboratory qualified to perform each type of analyses planned. The field engineer or geologist will obtain a statement or preferably standard DHS certification sheets that indicate the selected lab is qualified to perform each type analyses.

2. Where a mobile lab is utilized, the mobile lab must be qualified to perform each type of analysis planned for onsite processing. The field engineer/geologist will evaluate any additional restriction (e.g. such as distance from stationary lab, detection limits etc.) that may apply to the mobile lab and that may limit data use for report purposes. This information will be established prior to scheduling any field work.

3. All analytical procedures used for sample analysis will be California DHS or Environmental Protection Agency (EPA) approved method or equivalent. Methods approved by the DHS are as listed under Chapter 11, Title 22, Section 66699 and 66700 of the California Code of Regulations. Other methods that will be used by the laboratory will be covered under the following references or their updates:

    a) Standard Methods for Examination of Water and Wastewater (APHA), 16th edition, 1985.

    b) Test Methods for Evaluating Solid Waste: Physical/Chemical Methods, SW-846, 3rd edition, 1986.

    c) Methods for Organic Chemical Analysis of Municipal and Industrial Waste Water, EPA 600/4-82-057, 1982.

    d) Methods for Chemical Analysis of Municipal and Industrial Waste Water, EPA 600/4-82-057, 1982.

    e) Annual Book of ASTM Standards.

4. The field engineer or geologist or regulatory agency will specify the required laboratory detection limit(s) for each analyte with respect to the sample matrix (on the "Chain of Custody)". A table of typical detection limits and/or Practical Quantification Limits (PQL's) for common analytes is attached.

5. Whenever a water or soil sample is highly contaminated or very dilute, it may not be possible to obtain the specified detection limit without additional laboratory coordination. Where applicable, the field engineer or geologist will coordinate with the lab prior to field activities. The field engineer or geologist will take or specify additional measures to be implemented during field activities and/or at the laboratory if required.

6. Where relevant, the field engineer or geologist will identify samples with potentially high contamination levels, on the "Chain of Custody" record. This practice will significantly reduce problems with sample carry over and laboratory data quality prior to field activities.

7. Prior to field activities, the field engineer or geologist will establish by coordinating with the laboratory, the appropriate sample amounts, number and types of containers and preservation methods (if any, in addition to cooling samples to 4°C).

8. The field engineer or geologist will obtain and review the laboratory QA/QC protocol, prior to implementing field work. Variations (with the respect to regulatory practices) will be identified prior to field activities.

9. The field engineer or geologist will indicate the required turnaround time on the "Chain of Custody" form. For some analytes, shorter sample turn around time or holding times (than those specified by EPA SW-846 or in DHS draft methods) may be required. This may be due to certain regulatory policies or due to potential re-compositing and reanalyzing composite samples (sub-compositing), since subcomposites must also be analyzed within the specific holding time of the method. Where shorter turnaround time is required, the field engineer or geologist will coordinate with the lab prior to field activities and will clearly indicate "rush turnaround" and the time frame required for analysis on the "Chain of Custody".

10. Upon completion of the laboratory analysis, the field engineer/geologist and registered professional will establish whether: 1) all samples and analyses required by the work plan have been processed; 2) complete records exist for each analysis; 3) complete records exist for the associated QC samples and 4) the procedures specified in the work plan have been implemented.

11. Upon completion of the laboratory analysis, the field engineer/geologist and registered professional will compare the analytical results to the required detection limits and document any detection limits that exceed regulatory limits or action levels.

12. Upon completion of the laboratory analysis the field engineer/geologist and registered professional will review and compare sampling holding times to those specified in the work plan or based on DHS or EPA SW846 Methods and note all deviations.

LABORATORY ANALYSIS

EPA METHOD NO.	COMPOUND CLASS	TECHNIQUE	DETECTION RANGE (PARTS PER BILLION) SOIL	GRNDWATER	SAMPLE COLLECTION
8010/601	Purgeables Halogenated Volatile organics	GC-HALL	0.03-0.52	0.02-1.81	RF, Cl_2, 14
8015	Purgeables Non-Halogenated Volatile organics	GC-FID	NP[2]		RF, Cl_2, 14
8020/602	Aromatic Volatile Organics	GC-PID	0.2-0.4	0.2-0.4)	RF, Cl_2, 14
8030/603	Acrolein, Acrylonitrite, acetonitrile	GC-FID	0.5-0.6		RF, Cl_2, 14
8040/604	Phenols	GC-FID	0.14-16	0.14-16.0	RF, RC, NPR, Cl_2, pH 2, 7
8060/606	Phthalate Esters	GC-ECD	0.29-31		RF, NPR, 1, 7
8080/608	Organochlorine Pesticides + PCB's	GC-ECD	70-1000	0.002-0.14	RF, RC, NPR, 1, 7
8090/609	Nitroaromatics and Cyclic ketones	GC-FID or ECD	0.06-5.0		RF, RC, NPR, 1, 7

8100	Polynuclear Aromatic hydrocarbons	GC-FID	NP[2]		RF,RC,Cl_2,1,7

LABORATORY ANALYSIS

EPA METHOD NO.	COMPOUND CLASS	TECHNIQUE	DETECTION RANGE (PARTS PER BILLION) SOIL	GRNDWATER	SAMPLE COLLECTION
8120/612	Chlorinated Hydrocarbons	GC-ECD	0.03-1.3	0.03-04	RF,RC,NPR,1,7
8140/614	Organophosphorus Pesticides	GC-FPD or NPD	0.1-5.0	0.42-0.015	RF,RC,NPR,1,7
8150	Chlorinated Herbicides	GC-ECD or HALL	0.1-200		RF,RC,NPR,1,7
8240/624	Volatile Organics	GCMS	1.6-7.2	1.6-7.2	RF,LT,14
8270/625	Semi-Volatile Organics	GCMS	NP[2,5]	.09-44.0	RF,14
8310	Polynuclear Aromatic	HPLC UV and FLOUR	0.013-2.3		RF,RC,NPR,CL_2, 1,7

NOMENCLATURE

Instruments:

GC	Gas Chromatograph
GC/MS	Gas Chromatograph/Mass Spectrometer
HPLC	High Performance Liquid Chromatograph

Detectors:

ECD	Electron Capture

Flour	Fluorescence
FID	Flame Ionization
FPD	Flame Photometric
HALL	Electrolytic Conductivity
NPD	Nitrogen Phosphorus
PID	Photoionization
UV	Ultraviolet

GENERAL LABORATORY QUALITY ASSURANCE-QUALITY CONTROL PRACTICES

1. The laboratory sampling and analysis plan will provide for the use of standards, duplicates and spiked samples for calibration and identification of potential matrix interferences.

2. The laboratory quality control program will ensure that the following actions are completed:

    a) Calibration of laboratory instruments to within acceptable limits according to DHS, EPA or manufacturer's specifications before, after and during use. Reference standards will be used where necessary.

    b) Periodic inspection, maintenance and servicing (as necessary) of all laboratory instruments and equipment.

    c) The use of reference standards and quality control samples (e.g. checks, spikes, laboratory blanks, duplicates, or splits) as necessary to statistically determine the accuracy and precision of procedures, instruments and operators.

    d) The use of adequate statistical procedures (e.g. quality control charts) to monitor precision and accuracy of the data and to establish acceptable limits.

    e) A continuous review of results to identify and correct problems within the measurement system (e.g., instrumentation problems, inadequate operator training, inaccurate measurement methodologies).

    f) Documentation of the performance of systems and operations.

    g) Regular participation in external laboratory evaluations to determine the accuracy and overall performance of the laboratory. This will include performance evaluation and inter-laboratory comparison studies and formal field unit/laboratory evaluations and inspections.

3. The laboratory quality control program will also attempt to evaluate the accuracy and precision of analytical data in order to establish the quality of data for a given time frame.

4. The laboratory quality control program will also provide an indication of the need for corrective action when comparing data to establish criteria. The quality control program will determine the effect of corrective action.

5. A QA/QC Program Package and other related information from the selected laboratory is provided in this section. If the selected laboratory can not be utilized for some reason, the QA/QC may vary slightly.

STATE OF CALIFORNIA—HEALTH AND WELFARE AGENCY GEORGE DEUKMEJIAN, Governor

DEPARTMENT OF HEALTH SERVICES
2151 BERKELEY WAY
BERKELEY, CA 94704
(415) 540-2800

February 1, 1991

FEB 08 1991

Certificate No.: 1443

Curtis & Tompkins, Ltd.
Los Angeles Division
1250 South Boyle Avenue
Los Angeles, CA 90023

This is to advise you that the laboratory named above has been certified/registered as an environmental testing laboratory pursuant to the provisions of the California Environmental Laboratory Improvement Act of 1988 (Health and Safety Code, Division 1, Part 2, Chapter 7.5, commencing with Section 1010).

The fields of testing for which this laboratory has been certified/registered under this Act are indicated in the enclosed "List of Approved Fields of Testing Analytes." Certification/Registration shall remain in effect until February 28, 1993, unless revoked. This certificate is subject to an annual fee as prescribed by Section 1017(a), Health and Safety Code, on the anniversary date of the certificate.

Please note that your laboratory is required to notify the Environmental Laboratory Accreditation Program of any major changes in the laboratory such as the transfer of ownership, laboratory director, change in location, or structural alterations which may affect adversely the quality of analyses (Section 1014(b), California Health & Safety Code).

Until the new regulations pertaining to environmental laboratories are adopted the the existing regulations pertaining to drinking water and hazardous waste testing laboratories (California Code of Regulations, Title 22, Sections 64481-64499 and 67602-67606) will remain in effect to the extent that they are not superseded by the provisions of the Act.

Your continued cooperation is essential to establish a reputation for the high quality of the data produced by environmental laboratories certified by the State of California.

If you have additional questions, please contact Mr. William Ray at (415) 540-2800.

Sincerely,

George C. Kulasingam

George C. Kulasingam, Ph.D., Manager
Environmental Laboratory
Accreditation Program

ACCREDITATION/REGISTRATION
List of Approved Fields of Testing and Analytes

Curtis & Tompkins, Ltd. - Los Angeles
1250 South Boyle Avenue
Los Angeles, CA 90023
PHONE: (213) 269-7421
COUNTY: Los Angeles
LABORATORY CATEGORY: Commercial
CERTIFICATE NUMBER: 1443

1.0 Microbiology of Drinking Water and Wastewater ------(02-01-91)
1.1 Total Coliforms by Multiple Tube Fermentation -----Y
1.2 Fecal Coliforms by Multiple Tube Fermentation -----Y
1.3 Total Coliforms by Membrane Filter -----N
1.4 Fecal Coliforms by Membrane Filter -----N
1.5 Heterotrophic Plate Count -----Y
1.6 Total Coliforms by MMO-MUG Drinking Water Only--N
1.7 Fecal Coliforms by MMO-MUG Drinking Water Only--N

2.0 Inorganic Chemistry and Physical Properties of Drinking Water excluding Toxic Chemical Elements ------(02-01-91)
2.1 Alkalinity -----Y
2.2 Calcium -----Y
2.3 Chloride -----Y
2.4 Corrosivity -----Y
2.5 Fluoride -----Y
2.6 Hardness -----Y
2.7 Magnesium -----Y
2.8 MBAS -----N
2.9 Nitrate -----Y
2.10 Nitrite -----Y
2.11 Sodium -----Y
2.12 Sulfate -----Y
2.13 Total Filterable residue and Conductivity -----Y
2.14 Iron (Colorimetric Only) -----N
2.15 Manganese (Colorimetric Only) -----N

3.0 Analysis of Toxic Chemical Elements in Drinking Water ------(02-01-91)
3.1 Arsenic -----Y
3.2 Barium -----Y
3.3 Cadmium -----Y
3.4 Chromium, total -----Y
3.5 Copper -----Y
3.6 Iron -----Y
3.7 Lead -----Y
3.8 Manganese -----Y
3.9 Mercury -----Y
3.10 Selenium -----Y
3.11 Silver -----Y
3.12 Zinc -----Y
3.13 Aluminum -----Y
3.14 Asbestos -----N

4.0 Organic Chemistry of Drinking Water (measurement by GC/MS combination) ------(02-01-91)
4.1 Volatile Organics -----Y
4.2 Trihalomethanes -----N
4.3 Acid and Base/Neutral Compounds -----N

5.0 Organic Chemistry of Drinking Water (excluding measurements by GC/MS combination) ------(02-01-91)
5.1 Total Trihalomethanes -----N
5.2 Chlorinated pesticides -----N
5.3 Chlorophenoxy herbicides -----N
5.4 Halogenated Volatiles -----Y
5.5 Aromatic Volatiles -----Y
5.6 EDB and DBCP -----N
5.7 Polychlorinated Biphenyls -----N
5.8 Carbamates -----N
5.9 Nitrogen/Phosphorus Pesticides-----N

6.0 Radiochemistry ------(--------)
6.1 Gross alpha and beta and counting error -----N
6.2 Total Radium -----N
6.3 Radium 228 -----N
6.4 Uranium -----N
6.5 Radon 222 -----N
6.6 Radioactive Cesium -----N
6.7 Iodine 131 -----N
6.8 Radioactive Strontium -----N
6.9 Tritium -----N
6.10 Gamma emitting Isotopes -----N
6.11 Gross Alpha by Co-precipitation -----N

7.0 Shellfish Sanitation ------(--------)
7.1 Shellfish meat Microbiology -----N
7.2 Paralytic Shellfish Poison -----N

8.0 Aquatic Toxicity Bioassays ------(--------)
8.1 All Fresh Water: Static,Static/Renewal and Continuous Flow Bioassays; and Estuarine/Marine: Static, Static/Renewal, and Continuous Flow Bioassays -----N
8.2 Hazardous wastes Section 66696 (a) (4) -----N

9.0 Physical Properties Testing of Hazardous Waste ------(09-05-86)
9.1 Ignitability (Flashpoint determination Section 66702) -----Y

9.2 Corrosivity - pH determination ---------- Y

9.3 Corrosivity - Corrosivity towards steel (Section 66708) ---------- Y

9.4 Reactivity (Section 66705) ---------- Y

Inorganic Chemistry and Toxic Chemical Elements of Hazardous Waste

10.1 Antimony ---------- 6010(09-05-86) ---------- Y

10.2 Arsenic ---------- 7060(07-19-88) ---------- Y

10.3 Barium ---------- 6010(09-05-86) ---------- Y

10.4 Beryllium ---------- 6010(09-05-86) ---------- Y

10.5 Cadmium ---------- 6010(09-05-86) ---------- Y

10.6 Chromium, total ---------- 6010(09-05-86) ---------- Y

10.7 Cobalt ---------- 6010(09-05-86) ---------- Y

10.8 Copper ---------- 6010(09-05-86) ---------- Y

10.9 Lead ---------- 6010(09-05-86) ---------- 7421(02-01-91) ---------- Y

10.10 Mercury ---------- 7470(09-05-86) 7471(09-05-86) ---------- Y

10.11 Molybdenum ---------- 6010(09-05-86) ---------- Y

10.12 Nickel ---------- 6010(09-05-86) ---------- Y

10.13 Selenium ---------- 7740(07-19-88) ---------- Y

10.14 Silver ---------- 6010(09-05-86) ---------- Y

10.15 Thallium ---------- 6010(09-05-86) ---------- 7841(02-01-91) ---------- Y

10.16 Vanadium ---------- 6010(09-05-86) ---------- Y

10.17 Zinc ---------- 6010(09-05-86) ---------- Y

10.18 Chromium (VI) ---------- 7196(09-05-86) ---------- Y

10.19 Cyanide ---------- 9010(09-05-86) ---------- Y

10.20 Fluoride ---------- 340.2(09-05-86) ---------- Y

10.21 Sulfide ---------- 9030(09-05-86) ---------- Y

10.22 Total Organic Lead ---------- N

11.0 Extraction Tests of Hazardous Waste ---------- (09-05-86)

Section 66700 (WET) ---------- Y

11.2 Extraction Procedure Toxicity ---------- Y

11.3 Toxicity Characteristic Leaching Procedure (TCLP) ---------- Y

12.0 Organic Chemistry of Hazardous Waste (measurement by GC/MS combination) ---------- (--------)

12.1 Volatile compounds ---------- 8240(04-10-87) ---------- Y

12.2 Semivolatile compounds ---------- 8270(09-16-88) ---------- Y

13.0 Organic Chemistry of Hazardous Waste (excluding measurements by GC/MS combination)

13.1 Halogenated Volatiles ---------- 8010(07-19-88) ---------- Y

13.2 Non-Halogenated Volatiles ---------- 8015(05-05-88) ---------- Y

13.3 Aromatic Volatiles ---------- 8020(09-05-86) ---------- Y

13.4 Acrolein, Acrylonitrile, Acetonitrile ---------- N

13.5 Phenols ---------- 8040(09-05-86) ---------- Y

13.6 Phthalate Esters ---------- 8060(07-19-88) ---------- Y

13.7 Organochlorine Pesticides ---------- 8080(09-05-86) ---------- Y

13.8 Polychlorinated Biphenyls (PCBs) ---------- 8080(09-05-86) ---------- Y

13.9 Nitroaromatics and Cyclic Ketones ---------- N

13.10 Polynuclear Aromatic Hydrocarbons ---------- 8100(07-09-88) ---------- Y

13.11 Chlorinated Hydrocarbons ---------- 8120(07-19-88) ---------- Y

13.12 Organophosporus Pesticides ---------- 8140(09-05-86) ---------- Y

13.13 Chlorinated Herbicides ---------- 8150(09-05-86) ---------- Y

13.14 Carbamates ---------- 632(07-19-88) ---------- Y

13.15 Total Petroleum Hydrocarbons ---------- (05-05-88) ---------- Y

14. Bulk Asbestos Analysis ---------- (--------)

14 Section 66699 (1% or greater asbestos concentrations) ---------- N

15.0 Substances Regulated Under the California Safe Drinking Water and Toxic Enforcement Act (Proposition 65) and Not Included in Other listed Groups. ---------- N

16.0 Wastewater Inorganic Chemistry, Nutriants and Demand ---- (02-01-91)

16.1 Acidity ---- Y
16.2 Alkalinity ---- Y
16.3 Ammonia ---- Y
16.4 Biochemical Oxygen Demand ---- Y
16.5 Boron ---- Y
16.6 Bromide ---- Y
16.7 Calcium ---- Y
16.8 cBOD ---- Y
16.9 Chemical Oxygen Demand ---- Y
16.10 Chloride ---- Y
16.11 Chlorine Residual, total ---- Y
16.12 Cyanide ---- Y
16.13 Cyanide amenable to Chlorination ---- Y
16.14 Fluoride ---- Y
16.15 Hardness ---- Y
16.16 Kjeldahl Nitrogen ---- Y
16.17 Magnesium ---- Y
16.18 Nitrate ---- Y
16.19 Nitrite ---- Y
16.20 Oil and Grease ---- Y
16.21 Organic Carbon ---- Y
16.22 Oxygen, Dissolved ---- Y
16.23 pH ---- Y
16.24 Phenols ---- Y
16.25 Phosphate, ortho- ---- Y
16.26 Phosphorus, total ---- Y
16.27 Potassium ---- Y
16.28 Residue, Total ---- Y
16.29 Residue, Filterable (TDS) ---- Y
16.30 Residue, Nonfilterable (TSS) ---- Y
16.31 Residue, Settleable (SS) ---- Y
16.32 Residue, Volatile ---- Y
16.33 Silica ---- Y
16.34 Sodium ---- Y
16.35 Specific Conductance ---- Y
16.36 Sulfate ---- Y
16.37 Sulfide (includes total and soluble) ---- Y
16.38 Sulfite ---- Y
16.39 Surfactants (MBAS) ---- Y
16.40 Tannin and Lignin ---- Y
16.41 Turbidity ---- Y
16.42 Iron (Colorimetric Only) ---- N
16.43 Manganese (Colorimetric Only) ---- N

17.0 Toxic Chemical Elements in Wastewater ---- (02-01-91)

17.1 Aluminum ---- Y
17.2 Antimony ---- Y
17.3 Arsenic ---- Y
17.4 Barium ---- Y
17.5 Beryllium ---- Y
17.6 Cadmium ---- Y
17.7 Chromium (VI) ---- Y
17.8 Chromium, total ---- Y
17.9 Cobalt ---- Y
17.10 Copper ---- Y
17.11 Gold ---- N
17.12 Iridium ---- N
17.13 Iron ---- Y
17.14 Lead ---- Y
17.15 Manganese ---- Y
17.16 Mercury ---- Y
17.17 Molybdenum ---- Y
17.18 Nickel ---- Y
17.19 Osmium ---- N
17.20 Palladium ---- N
17.21 Platinum ---- N
17.22 Rhodium ---- N
17.23 Ruthenium ---- N
17.24 Selenium ---- Y
17.25 Silver ---- Y
17.26 Strontium ---- Y
17.27 Thallium ---- Y
17.28 Tin ---- Y
17.29 Titanium ---- N
17.30 Vanadium ---- Y
17.31 Zinc ---- Y

18.0 Organic Chemistry of Wastewater (measurements by GC/MS combination) ---- (02-01-91)

18.1 Volatile Organics ---- Y
18.2 Acid and Base/Neutral compounds ---- Y

19.0 Organic Chemistry of Wastewater (excluding measurements by GC/MS combination) ---- (02-01-91)

19.1 Halogenated Volatiles ---- Y
19.2 Aromatic Volatiles ---- Y
19.3 Acrolein, Acrylonitrile, Acetonitrile ---- Y
19.4 Phenols ---- Y
19.5 Benzidine ---- Y
19.6 Phthalate Esters ---- Y
19.7 Nitrosoamines ---- Y
19.8 Organochlorine Pesticides ---- Y
19.9 Polychlorinated Biphenyls ---- Y
19.10 Nitroaromatics and Cyclic Ketones ---- Y
19.11 Polynuclear Aromatics ---- Y
19.12 Haloethers ---- Y
19.13 Carbamates ---- Y

This laboratory is also certified for additional hazardous material test categories under Certificate No. _______.

This laboratory is also certified for additional drinking water test categories under Certificate No. _______.

8.0 LABORATORY QUALITY ASSURANCE PROGRAM

8.1 INTRODUCTION

The purpose of a quality assurance program is to establish, monitor and control factors contributing to the reliability of analytical data. Approved methodologies, personnel training, and detailed quality control procedures are needed to assure correct analytical data. The management of Curtis & Tompkins, Ltd. (C&T) has established a policy to implement and enforce a quality assurance program for use in both of its laboratories. This is a summary of items covered in the Quality Assurance Manual. You may request a controlled copy of the Curtis & Tompkins manual for further review.

8.2 ORGANIZATION

C&T's laboratories are organized to facilitate sample management, analytical performance management and data management. Laboratory personnel are assigned specific tasks to ensure implementation of the QA/QC program. Each laboratory has Quality Assurance (QA) personnel who report directly to the President and are responsible for program effectiveness and compliance. Laboratory Directors manage through Group Leaders, each responsible for a specific range of QA/QC specifications. The Group Leaders oversee analyses and give technical direction and supervision to assigned staff.

8.3 DATA REVIEW

Final reports are reviewed three times. First, Group Leaders review and certify that the analyst's raw data complies to technical controls, documentation requirements and standard procedures. Second, a comprehensive report and data review is performed by the QA Officer or Project Manager, who has authority to stop production to ensure implementation of the QA/QC plan. This includes certifying that data packages comply to specifications for sample holding conditions, COC, QA/QC control (acceptance) limits, data documentation and that the final report is free of transcription errors. Third, the Laboratory Director reviews the entire data package and signs the client report. The QA Officer and Group Leaders are trained and authorized to review and sign reports in the Laboratory Director's absence. All raw laboratory data and final reports are stored for 5 years.

The Client Services Technicians play a key role in the organization. They are responsible for the care, custody and control of all samples for analysis and for the accumulation and consolidation of the analytical results, including internal quality controls and approvals. They control scheduling priorities which enable the Group Leaders to concentrate on analytical performance of their instruments and subordinate personnel without undue administrative distraction.

Client Services Technicians also serve as Sample Custodians. The Sample Custodian is responsible for the log in of samples. Upon sample receipt, the Sample Custodian inspects each sample to evaluate condition, compares the sample labels to the description presented on the chain-of-custody, and certifies that all samples are accounted for.

The analysts, under the direction of Group Leaders, perform the analyses and initial data review. Each analyst must check and initial their work, making certain that it is complete, determining that the instrumentation has been properly calibrated, and insuring that the analysis has been performed within the QA/QC limits. Completed work is submitted to the Group Leader for review.

The Group Leaders evaluate the data submitted by the analyst by first assessing the validity of the analytical method chosen for the analysis. They verify that the data and documentation are complete, that each analysis has been performed within QA criteria specific to each method, check calculations, assemble and sign the data package, then submit it to Client Services for report preparation.

8.4 QUALITY ASSURANCE PROJECT PLANS

A complete program to generate data of acceptable quality must be project specific, include both a Quality Assurance (QA) component, which encompasses the management procedures and controls, as well as an operational day-to-day Quality Control (QC) component. Clients are encouraged to prepare a Quality Assurance Project Plan (QAPjP) in accordance with guidance from the data users laboratory and/or reviewing agencies to ensure that data quality objectives are met.

Projects received in the laboratory without specific QAPjP's shall be processed in accordance with the procedures and practices outlined in the Curtis & Tompkins Quality Assurance Manual. Projects received in the laboratory accompanied by a QAPjP will be assigned a Project Manager to work in close coordination with the QA Officer and the Client to understand and meet the specifications and requirements of the QAPjP.

The Laboratory Director or Operations Manager is responsible for assigning a Project Manager (PM). The PM is responsible for understanding and communicating the requirements detailed in the QAPjP to the QA Officer and all involved staff prior to beginning the project. Subsequently, the understanding and commitment to meet all QAPjP specifications is obtained by all affected staff prior to the beginning of the project. The PM is responsible for client communications throughout the term of the project.

The QA Officer shall be responsible for insuring that all QAPjP specific procedures are followed, precision and accuracy specifications are met, QA/QC reporting requirements are fulfilled, and that the PM is advised of all aspects of compliance to the QAPjP objectives.

8.5 CHAIN-OF-CUSTODY

Analyses have no validity unless all aspects of sample collection, transport, receipt, analysis and data compilation can be validated. Because of the nature of the data being collected, the possession of samples must be traceable from the time the samples are collected until final disposal. A chain-of-custody (COC) must be provided with samples to insure validity to all aspects of sample collection, transport, receipt, analyses and data compilation. A sample of the Curtis & Tompkins' COC is located under section 2.0.

8.6 LOG-IN OF SAMPLES

All chain-of-custody samples are logged in by a Sample Custodian. In addition to the data required on the chain-of-custody form, the Sample Custodian documents the sample shipment condition including sealing tape, custody seals and verifies the sample tag information against custody records. Any observations, errors, or discrepancies are recorded and resolved before analytical procedures are initiated. Each sample received is assigned a laboratory number. Laboratory numbers are affixed to each sample using colored adhesive label tags. The laboratory numbers identify each sample by job number, such that any sample can be quickly and uniquely identified. Each sample is recorded in the Log-In Record by client and laboratory identification numbers. Samples are logged in promptly upon receipt and never left unattended. The Sample Custodian assumes custody of the samples upon receipt signature on the COC. All paperwork and samples are marked to indicate chain-of-custody status and kept in secured storage.

8.7 SAMPLE PRESERVATION

The Client Services Group applies the following guidelines to ensure sample preservation:

1) When a client requests sample containers, sample preservation is arranged ,if requested.

2) When the empty sample containers are shipped from the laboratory, a label is affixed to the container disclosing the presence of preservatives, if added, and the expected method or analyte application for the containers.

3) When samples arrive at the laboratory, the Client Services Group verifies the preserved state of the samples by the following:
   - a) Requesting client information on the preservation techniques applied.
   - b) Verifying the preservatives have been added by simple chemical checks (as stated in the method files), and
   - c) Verifying the "pre-preserved" status of the sample containers by examination of the labels.

4) The preserved state of the samples is documented upon receipt on the chain-of-custody form.

8.8 SAMPLE STORAGE

All samples are kept secure in a locked room, cabinet or refrigerator during storage (i.e., while not being analyzed). To remove samples from storage, the laboratory analyst must sign for the samples on the internal custody log book. The sample log book is maintained by the Sample Custodian. Chain-of-custody samples and laboratory records are returned to the Sample Custodian and secured at the end of each day or earlier if analyses are completed. All samples checked in or out are initialed by the Sample Custodian at the end of each work day.

8.9 SAMPLE ANALYSES

Instruments are first verified to be in proper working order. Mass spectrometers must meet tuning specifications; chromatographic systems are baked out; other instruments are turned on and allowed to warm up for a designated period of time. If the instrument is not functioning properly at this point, the problem is identified and corrected.

Calibration standards and blanks are then analyzed. The calibration standards and blanks must meet the acceptance criteria specified in the SOP for the analytical method. Blank contamination or poor recovery of the standard requires investigation and correction before proceeding further with analysis of samples.

Blanks and calibration verification standards are analyzed as frequently as specified in the method. Data quality objectives, instrument stability, method choice, matrix, and potential contamination will affect the frequency. Method blanks, blank spikes, matrix spikes (if applicable) and samples are analyzed.

8.10 SAMPLE TRACKING AND DISPOSAL

Once samples have been logged into LIMS, the Client Services Group initiates the job by placing the pertinent work information on a job jacket form. The form is affixed to a manila folder in which all the analytical results and reports will be placed as the job progresses. The form, envelope and data contained inside comprise the Job Jacket.

Each job is assigned a laboratory identification number (sequential) generated on the log-in form. Each laboratory sample number is generated sequentially using the laboratory identification number assigned to the job jacket. In this way the sample identification number can be used to trace the sample to the job jacket and to the sample log-in. The job jacket also contains a description of the scope of services to be performed to fulfill project requirements

Samples are maintained in controlled storage by the Client Services Group for 30 days after completion of analyses. The samples are disposed of using current federal and state requirements.

If requested, samples will be returned to the client or stored under controlled conditions for a specified period of time.

Hazardous materials from laboratory waste and residual samples are disposed of in an appropriate manner as designated by state or federal regulations and good laboratory practices. Materials which cannot be disposed of in the sewage or municipal solid waste systems are categorized, labeled and stored prior to disposal by a licensed waste disposal firm. The Facilities Manager is responsible for assuring proper collection, storage and disposal of all laboratory waste. Each laboratory maintains a laboratory waste management SOP and chain of responsibility.

8.11 ANALYTICAL METHODS

The methods employed in C&T laboratories are specified, approved or recommended by regulatory agencies, or they are consensus methods. Because of the large variety of matrices analyzed in C&T laboratories, a number of references are utilized. Specific method references for analyses are listed in the Methods Files.

C&T maintains methods uniformity among both of it's laboratories. Referenced analytical methods are cited and on-going performance and QA criteria are documented in Laboratory Methods Files. Maintaining and updating individual files is the responsibility of the Group Leaders. Maintenance and organization of the filing system is the responsibility of the Client Services group. Each method cited in Methods Files is dated and requires the approval of the Group Leader(s) and Laboratory Director(s).

8.12 CORRECTIVE ACTION PROCEDURES

This procedure outlines the steps that are required to be taken when QA/QC procedures indicate analyses do not conform.

If sample loss or damage occurs, a Corrective Action Notice will be initiated and the Client contacted immediately. When method specific QA/QC procedures such as spike recoveries, duplicate RPD, calibration response factors, or other QA dependent criteria cannot be met by the analyst, a Corrective Action Report will be initiated.

The Corrective Action Notice will be completed within 4 hours of the non-conformance. The notice will be signed by the analyst, Group Leader and QA Officer, and, if necessary, in the judgement of the QA Officer, the Laboratory Director. The Corrective Action Notices are maintained in three-ring binders in chronological order for a period of no less than 3 years. The QA Officer maintains a Corrective Action Notice Binder for each laboratory group.

At the request of the QA/QC Officer, the Laboratory Director and each Group Leader will review the Corrective Action Notices to implement changes in procedures, analyst training, or recommend purchase of new equipment to remediate re-occurring non-conformances.

If corrective action cannot remediate the non-conformance, and results of sample analysis are affected, the Laboratory Director is notified. If in the Laboratory Director's judgement, results of sample analysis are affected, a summary of non-conformance QA procedures must be communicated to the Client with the results of the affected analyses.

8.13 RECORD KEEPING

The Client Services Group shall maintain all sample records in a secure and organized manner until project completion, and thereafter. Project results, client deliverables including laboratory worksheets, computer generated reports and other project specific data shall be submitted to the QA Officer and subsequently, the Laboratory Director or his designee, for review and signature prior to being released to the client.

Procedures describing the means for generating, controlling and archiving laboratory records shall be specified in writing as part of the S&D (Sample & Data) Group Standard Operating Procedure's (SOP). These procedures will specify record generation and control, and the requirements for record retention, including type, time, security, retrieval and disposal authorities.

APPENDIX B

LISTS OF CHEMICAL COMPOUNDS USED OR STORED ON-SITE

TABLE 1

PARTIAL LIST OF MATERIALS IDENTIFIED IN BUILDING 5 STORED IN 55-GALLON DRUMS

- 3 drums of Hydraulic Oil (for injection molding equipment)
- 2 drums of Shell Epon 815 resin (glue)
- 2 drums of Versamid 125
- 1 drum of Tetrahydrofuran (waste)
- 1 drum of 1,1,1-Trichloroethane (waste)
- 2 drums of Methylene Chloride
- 1 drum of Shell Epon 828
- 1 drum of Zelac
- 1 drum of Toluene
- 2 drums of Methanol
- 1 drum of Glycol Ether Acetate
- 1 drum of Base Oil
- 3 drums of Trichloroethylene
- 3 drums of Styrene
- 4 drum of Tetrahydrofuran
- 1 drum of Lacquer Thinner
- 1 drum of Deoderizer Spray Base
- 1 drum of Pella Oil
- 1 drum of B-485 Liquid

APPENDIX 1

HAZARDOUS MATERIALS INFORMATION SUBMITTED TO THE VAN NUYS FIRE PREVENTION BUREAU

Submitted 6-30-83

Location	Chemical	Maximum Quantity Stored
outside building	methanol	100 gal
	styrene manomer	200 gal
	acetone	200 gal
	laquer thinner	50 gal
	tetrahydrofuran	200 gal
	cellosolve acetate	50 gal
	methyl isobutyl ketone	50 gal
	methyl ethyl ketone	50 gal
	toluene	50 gal
	acrylic resin solution	100 gal
	polyester resin	1000 gal
factory building		
dip tank oven	acrylic resin	10 gal (in use)
dip tank pultruder	polyester resin	100 gal (in use)
meter mixer packager	epoxy resin	100 gal
salt tank	polyester fiberglass	50 lb

Submitted 3-26-86

Location	Chemical	Maximum Quantity Stored
outside building	methanol	100 gal
	styrene manomer	200 gal
	acetone	200 gal
	laquer thinner	50 gal
	tetrahydrofuran	200 gal
	cellosolve acetate	50 gal
	methylene chloride	50 gal
	1,1,1 trichloroethylene	50 gal
	toluene	50 gal
	acrylic resin solution	100 gal
	polyester resin	1000 gal
	benzoyl peroxide	50 lbs
	tertiary butyl perbenzoate	50 lbs
factory building		
dip tank oven	acrylic resin	10 gal (in use)
dip tank pultruder	styrene polyester resin	100 gal
meter mixer packager	epoxy resin	100 gal
salt tank	polyester fiberglass	50 lbs (in use)

ADDITIONAL CHEMICAL COMPOUND DESCRIPTIONS FOR NUPLA CORPORATION SITE

EPON 828: bis-phenol epichlorohydrin resin

Zelac: alcohol phosphate

Glycol Ether Acetate: ethylene glycol monoethyl ether acetate, or cellosolve acetate

glycidoxypropyltrimethoxysilane

diethylenetriamine

cadmium (pigments)

Titanox: titanium dioxide (pigments)

Luperco ANS: benzoyl peroxide with organic/inorganic fillers

potassium nitrate (texturizing bath)

Percadox: peroxide catalyst

EPON 815 Epoxy Resin:	bis-phenol a/epichlorohydrin resin	86.5%
	t-butyl glycidyl ether	13.5%
	epichlorohydrin	<10 ppm

Acryloid B 485:	acrylic copolymer	45%
	methyl methacrylate	1 %
	toluene	54%

Polylite 92-301: unsaturated polyester alkyd

EKS 2600 Phenolic:	phenol resin	50%
	methanol	50%

Acryloid A-21:	acrylic copolymer	94%
	methyl methacrylate	1%
	toluene	5%

Versamid 125:

polyamide resin	89%
triethylene tetramine	11%

Cabosil: colloidal silicon dioxide

di-octyl pthalate